ISSN 1333-6347
UDC (515.12/.17) (929)Mardešić

Pregledni rad
Review

Akademik Sibe Mardešić, matematičar i profesor (1927. – 2016.)*

Academician Sibe Mardešić, mathematician and professor (1927–2016)*

Darko Veljan**
Prirodoslovno-matematički fakultet, Matematički odsjek, Sveučilište u Zagrebu /
Faculty of Sciences, Department of Mathematics, University of Zagreb
Bijenička cesta 30, HR-10000 Zagreb, Croatia; e-mail: darko.veljan@gmail.com

Primljeno / *Received*: 2022-08-01; Prihvaćeno /*Accepted*: 2022-10-13

SAŽETAK

Akademik Sibe Mardešić bio je svjetski poznati hrvatski matematičar s više od 200 znanstvenih i stručnih članaka i drugih radova te oko 20 knjiga, monografija i udžbenika uglavnom iz područja algebarske topologije, teorije oblika i matematičke analize. Čitav radni vijek proveo je na Odsjeku za matematiku Prirodoslovno-matematičkog fakulteta (PMF) Sveučilišta u Zagrebu, gdje je na dodiplomskom studiju predavao razne predmete – od matematičke analize, topologije, algebre i drugih. Jedan je od osnivača prvoga poslijediplomskoga studija matematike u ovom dijelu Europe (1960.); bio je voditelj i prvi predavač na tome studiju u Zagrebu i voditelj pripadnoga seminara (kružoka). Također je jedan od osnivača studija matematike u

SUMMARY

Academician Sibe Mardešić was a world-known Croatian mathematician with more than 200 scientific and professional papers and other works, as well as 20 books, monographs and textbooks mostly from the area of algebraic and general topology and mathematical analysis. He worked at the Department of Mathematics within the Faculty of Sciences (PMF), University of Zagreb. He taught many undergraduate courses such as mathematical analysis, topology and algebra. He was one of the founders of the first graduate study of mathematics in this part of Europe (1960) and the first lecturer at that graduate school in Zagreb who led the graduate seminar. He co-founded the Department of Mathematics at the University of Split. He was a guest professor or visiting professor, invited to many well-known universities around the world, from the USA, Mexico, around

* Članak je djelomice referiran na znanstvenom skupu *Hrvatski prirodoslovci 31,* Split, 25. – 26. studeni 2022.
* *The paper was partially referred at the scientific meeting* Croatian naturalists 31*, Split, Croatia, November 25–26, 2022.*
** Sada u miru. / ***Now retired*.

Splitu. Bio je gostujući profesor ili je posjetio po pozivu brojna ugledna sveučilišta diljem svijeta, od SAD-a, Meksika, gotovo čitavu Europu, od Japana do Rusije, Ukrajine i Turske. Smatra se jednim od osnivača i svjetskih eksperata teorije oblika (vrste globalne teorije homotopije). Bio je dugogodišnji glavni i odgovorni urednik *Glasnika matematičkog* i član uredništva više inozemnih i domaćih časopisa. Objavio je gotovo 300 referata (opisa radova) u američkom referativnom časopisu *Mathematical Reviews* i oko 180 u njemačkom časopisu *Zentralblatt*. Osnivač je i sudionik više domaćih i međunarodnih konferencija, primjerice u Dubrovniku. Bio je dekan i prodekan fakulteta, predsjednik Hrvatskoga matematičkog društva (HMD) i suradnik (fellow) Američkoga matematičkog društva (AMS). Bio je redoviti član Hrvatske akademije znanosti i umjetnosti, HAZU (prije JAZU) i Europske akademije. Dobitnik je nagrade *Ruđer Bošković*, nagrade grada Zagreba i nagrade za životno djelo. Desetak dana nakon smrti objavljena mu je impresivna matematička, kulturološko-povijesna i životna autobiografija na gotovo 500 stranica koju je pomalo pisao tijekom nekoliko godina.

KLJUČNE RIJEČI

Sibe Mardešić
– profesor matematike
– teorija homologije
– teorija oblika
– topologija

Obiteljsko podrijetlo, djetinjstvo i srednja škola

U svojoj autobiografiji (1), Sibe (Josip) Mardešić kaže da je prezime Mardešić iz Knina na otok Vis, odnosno Komižu,

Europe, Japan to Russia, Ukraine and Turkey. They saw him as one of the founders and world experts in shape theory (global homotopy theory). For years he was the editor-in-chief of Glasnik matematički and a member of the editorial board of a number of domestic and foreign journals. He published almost 300 reviews in the American journal Mathematical Reviews and almost 180 in the similar German Zentralblatt. He founded and participated in a number of international conferences, for instance, the one in Dubrovnik. He was the dean and the vice-dean of the faculty, president of the Croatian Mathematical Society (HMD) and a fellow of the American Mathematical Society (AMS). He was a full member of the Croatian Academy of Science and Art (HAZU, formerly JAZU) and of the European Academy. He received the Ruđer Bošković award, the award of the City of Zagreb and the lifetime achievement award. Ten days after his death the impressive mathematical, culturological-historical and autobiographical book of almost 500 pages appeared which he wrote for many years.

KEYWORDS

Sibe Mardešić
– homology theory
– professor of mathematics
– shape theory
– topology

Family background, childhood and high school

In his autobiography (1), Sibe (Josip) Mardešić says that the surname Mardešić came from Knin to the island of Vis, or Komiža, at the beginning of the 16th century. Sibe's grandfather Josip (Sibe) and father (Pavao) were born in Komiža, and, among other things, were engaged in fishing for sardines with so-called „gajeta Falkuša" in Palagruža and other Adriatic fishing grounds. Sibe's other grandparents

došlo početkom 16. stoljeća. U Komiži su rođeni Sibin djed Josip (Sibe) i otac (Pavao), koji su se, među ostalim, bavili i ribolovom gajetom falkušom na srdele u Palagruži i drugim jadranskim lovištima. Drugi Sibini baka i djed bili su Josip (Bepo) Karaman i baka Eulalija Karaman (rođ. Nakić), nakladnici i organizatori prvih kina u Splitu. Sibin otac Pavao (1895. – 1978.) diplomirao je brodogradnju i strojarstvo u Beču, a majka Anka (1898. – 1986.), rođ. Karaman, završila je splitsku klasičnu gimnaziju. Roditelji su od 1922. do 1929. živjeli u Hamburgu, a Sibe se rodio u Bergedorfu (predgrađe Hamburga) 20. lipnja 1927., a kršten je u obližnjoj katoličkoj crkvi. Nakon kraćeg boravka u Čileu, a uslijed svjetske krize, obitelj se polovicom 1930. vraća u Split. Od dolaska u Split do odlaska na služenje obveznog vojnog roka u Jugoslavensku narodnu armiju (JNA) 1945., odnosno odlaska na studij u Zagreb, Sibe je proveo u Splitu kojeg je uvijek osjećao kao svoj zavičaj, a obiteljsku kuću u Podšpilju kod Komiže na otoku Visu kao ljetnu kuću za odmor.

U Splitu je Sibe Mardešić završio osnovnu i srednju školu, s tim da je u 4. razredu realne gimnazije (u dobi od 14 godina) dočekao početak Drugoga svjetskoga rata (travanj, 1941.). Otac je odlučio da Sibe i njegov mlađi brat Uroš ne će ići u školu dok traje rat, nego su učili i polagali ispite kod kuće. Tijekom talijanske okupacije dijelova Hrvatske za vrijeme Nezavisne Države Hrvatske (NDH), Sibe i brat mu privatno su polagali 5. do 7. razreda. Tada naučeni talijanski kasnije mu je dobro došao kad je predavao matema-

were Josip (Bepo) Karaman and grandmother Eulalija Karaman (née Nakić), publishers and organizers of the first cinemas in Split. Sibe's father Pavao (1895–1978) graduated in shipbuilding and mechanical engineering in Vienna, and mother Anka (1898–1986), born Karaman, she graduated from Split's classical high school. From 1922 to 1929, his parents lived in Hamburg, and Sibe was born in Bergedorf (a suburb of Hamburg) on June 20, 1927, and was baptized in a nearby Catholic church. After a short stay in Chile, due to the world crisis, the family returned to Split in the middle of 1930. From his arrival in Split until his required military service in the Yugoslav People's Army (JNA) in 1945, i.e. his departure to study in Zagreb, Sibe spent his time in Split, which always felt like his home, and the family house in Podšpilje near Komiža on the island Vis. In Split, Sibe Mardešić finished primary and secondary school, with the fact that in the 4th grade of the real gymnasium (at the age of 14) he saw the start of World War II (April, 1941). The father decided that Sibe and his younger brother Uroš would not go to school during the war, but instead studied and took exams at home. During the Italian occupation of parts of Croatia through the Independent State of Croatia (NDH), Sibe and his brother took their 5th to 7th grades privately. The Italian he learned then came into practice later when he taught mathematics at various Italian universities to which he was invited. In addition, he also studied German, which he „had in his ear" since he was born (in Hamburg). He also started learning English privately during the war, but his Jewish teacher was taken away by the Germans and killed, and he soon continued with another English (and French) teacher. After World War II, English became the predominant language, the *lingua franca*, in which Sibe Mardešić taught, wrote and communicated

tiku na raznim talijanskim sveučilištima na koje je bio pozivan. Osim toga, učio je i njemački koji je već od rođenja (u Hamburgu) „imao u uhu". Engleski je također počeo učiti privatno za vrijeme rata, ali su mu učiteljicu Židovku Nijemci odveli i ubili, no nastavio je ubrzo s drugom učiteljicom engleskog (i francuskog). Nakon Drugoga svjetskoga rata, engleski je ionako postao prevladavajući jezik, *lingua franca*, na kojem je Sibe Mardešić predavao, pisao i komunicirao diljem svijeta. U ožujku 1945. upoznao je starijeg kolegu Berislava Makjanića, koji ga je uputio na studij matematike na upravo osnovani PMF u Zagrebu. Maturu je 1945. polagao po skraćenom postupku i nikad nije prežalio što je nije završio „normalno". No, ipak, čini se da mu je to dalo dodatnu inspiraciju i snagu da dostigne i prestigne „normalne" srednjoškolce.

Student matematike, asistent, doktorat, Princeton

Najopsežniji izvori informacija o životu i radu akademika Sibe Mardešića njegova je sjajna autobiografija (1). Zatim su tu članci (2, 3), knjiga iz povijesti znanosti (4) i druge navedene na kraju popisa literature. Ovdje ćemo za čitatelje *Prirodoslovlja* navesti i neke nove pojedinosti iz životnog puta Sibe Mardešića, kao i o njegovu bogatom znanstvenom i profesorskom opusu.

Ujesen 1946. Sibe Mardešić upisuje Matematičko-fizički odsjek PMF-a na Marulićevu trgu 19 u Zagrebu (**slika 1**), koji se netom odvojio od Mudroslovnoga odnosno Filozofskoga fakulteta.

all over the world. In March 1945, he met an older colleague, Berislav Makjanić, who guided him to study mathematics at the just-founded PMF in Zagreb. In 1945, he took his maturity exam on the condensed procedure and never regretted that he did not finish it „normally". However, it seems that this gave him additional inspiration and strength to reach and surpass „normal" high school students.

Mathematics student, Assistant, Ph.D., Princeton

The most extensive sources of information about the life and work of academician Sibe Mardešić are his excellent autobiography (1). Then there are the articles (2, 3), a book on the history of science (4) and others listed at the end of the references list. Here, for the readers of Prirodoslovlje, we will provide some new details from Sibe Mardešić's life path, as well as about his rich scientific and professorial work.

SLIKA 1. **Zgrada PMF-a, Marulićev trg 19, Zagreb, oko 1982. (1, str. 36)**

FIGURE 1. ***PMF building, Marulić Square 19, Zagreb, around 1982 (1, p. 36)***

In the fall of 1946, Sibe Mardešić enrolled in the Mathematics-Physics Department of the PMF at Marulić Square 19 in Zagreb (**Figure 1**), which separated from the „Mudroslovni" i.e. Faculty of Philosophy.

Sibe je tada stanovao u podstanarskoj sobici (3,50 m × 1,70 m) na Staljinovu, kasnije Krešimirovu trgu 8, kod gospođe Štefice Vićan, rodom iz Mostara, punih sedam godina. Profesori i asistenti na fakultetu su mu bili Đuro Kurepa (5), koji je naslijedio profesora Vladimira Varićaka (6), Rudolf Cesarec (7), Mladen Paić i Stanko Bilinski (8, 9), Zlatko Janković (10), Vladimir Vranić (11) i Željko Marković (12). Vježbe nekih predmeta mu je držao Pavle Papić (13). Sviđala su mu se predavanja iz geometrije profesora Bilinskoga i Cesarca.

Na studiju je Sibe upoznao buduću suprugu Veru Župarić-Mardešić (1930. – 2021.), rodom iz Osijeka, s kojom je bio u skladnom braku više od 65 godina (**slika 2**). Vjenčali su se 14. studenoga 1951. u crkvi Sv. Marka. Vera je također diplomirala u jesen 1953. kod profesora Đure Kurepe s temom *Konveksne funkcije*. Kasnije je magistrirala i predavala matematiku na Fakultetu strojarstva i brodogradnje (FSB) u Zagrebu. Pratila je Sibu na brojnim znanstvenim skupovima u zemlji i svijetu. Imali su dvoje djece: Milica Mihaljević (rođena Mardešić, 1958.), jezikoslovka na Institutu za hrvatski jezik i jezikoslovlje, i Pavo (r. 1960.), matematičar i profesor u Dijonu, Francuska, stručnjak iz dinamičkih sustava.

Sibe Mardešić uživao je u svom studentskom životu, bio je izvrstan student, s lakoćom je savladao gradivo, pjevao s društvom ulicama Zagreba (Jurjevska ulica, Cmrok itd.). Diplomirao je u jesen 1950. Profesor Marković mu je na kauzalnom ispitu zadao dva zadatka: 1. opisati

At that time, Sibe lived in a tenant's room (3.50 m x 1.70 m) at Staljin, later Krešimir Square 8, at Mrs. Štefica Vićan, a native of Mostar, for seven years. His professors and assistants at the faculty were Đuro Kurepa (5), who succeeded professor Vladimir Varićak (6), Rudolf Cesarec (7), Mladen Paić and Stanko Bilinski (8, 9), Zlatko Janković (10), Vladimir Vranić (11) and Željko Marković (12). Pavle Papić (13) led some practice subjects. Mardešić liked the geometry classes by professors Bilinski and Cesarec.

SLIKA 2. **Vera i Sibe Mardešić, Zagreb, 1950. (1, str 34)**

FIGURE 2. ***Vera and Sibe Mardešić, Zagreb, 1950 (1, p. 34)***

In their student days, Sibe met his future wife, Vera Župarić-Mardešić (1930–2021), a native of Osijek, with whom he was happily married for more than 65 years (**Figure 2**). They married on November 14, 1951 in the church of St. Mark in Zagreb. Vera also graduated in the fall of 1953 by professor Đuro Kurepa with the thesis *Convex functions*. Later, she earned her master's degree and lectured mathematics at the Faculty of Civil Engineering and Shipbuilding (FSB) in Zagreb. She travelled with Sibe to numerous scientific meetings

Cantorov trijadski skup, i 2. riješiti jedan zadani sustav od četiri obične linearne diferencijalne jednadžbe. Profesor Cesarec mu je zadao ova dva pitanja: 1. odrediti pupčaste točke jedne zadane plohe, i 2. odrediti jednadžbu loksodrome, tj. krivulje na sferi koja siječe sve meridijane pod istim kutom. Sibe je to riješio više-manje rutinski i diplomirao s odlikom.

Oko godine 1951. Sibe je od profesora Željka Markovića, kojem je bio asistent (1950./1951.) prvi put čuo riječ „topologija" i „dinamički sustavi". – „Time bi se Vi kolega, mogli početi baviti...", Marković je predložio Sibi Mardešiću, kako je mnogo kasnije rekao Sibe. Ostalo je povijest. Sibe je zagrizao tu udicu i napravio svjetski uspješnu karijeru, kao što ćemo vidjeti u nastavku ovoga članka.

Sibe Mardešić bio je asistent na PMF-u 1951. – 1957. Vodio je vježbe iz predmeta *Diferencijalni i integralni račun* te iz *Teorije funkcija kompleksne varijable*. U međuvremenu je objavio prve radove: *Preslikavanja prostora kod zrcaljenja na šupljoj staklenoj kugli* i *O visinama trokuta u hiperboličkoj geometriji*, oba u *Glasniku Mat.-Fiz. Astron*. Oba su rada bila iz geometrije, više stručna nego čisto znanstvena, te rad (14) iz algebre na njemačkom, također u *Glasniku*.

No, tih je godina po naputcima Ž. Markovića temeljito proučavao knjigu H. Seiferta i W. Threlfalla (15) iz topologije (na njemačkom), a nešto kasnije knjige iz algebarske topologije autora: S. Lefschetz, S. Eilenberg i N. Steenrod te P. Aleksandrova i H. Hopfa. Zanimljivo, Seifert mu je mnogo kasnije rekao da su veći dio svo-

in the country and abroad. They had two children: Milica Mihaljević (born Mardešić, 1958), a linguist at the Institute of Croatian Language and Linguistics, and Pavo (born 1960), a mathematician and professor in Dijon, France, an expert on dynamical systems.

Sibe Mardešić enjoyed his student days, he was an excellent student, he passed easily all exams, and he sang with his friends in the streets of Zagreb (Jurjevska ulica, Cmrok, etc.). He graduated in the fall of 1950. Professor Marković asked him two questions on the causal exam: 1. describe Cantor's triadic set, and 2. solve a given system of four ordinary linear differential equations. Professor Cesarec asked him the following two questions: 1. determine the extreme points of a given surface, and 2. determine the equation of the loxodrome, i.e. the curve of the sphere which intersects all meridians at the same angle. Sibe solved it more or less routinely and graduated with best grade.

Around 1951, Sibe first heard the terms words „topology" and „dynamical systems" from professor Željko Marković, to whom he was an assistant (1950/1951). – „You, colleague, could start studying that stuff...", Marković suggested to Sibe Mardešić, as Sibe said to us many years later. The rest is history. Sibe bit the hook and made a worldwide successful career, as we will see in the rest of this article.

Sibe Mardešić was a teaching assistant at PMF from 1951 till 1957. He led the practice of subjects *Differential and integral calculus* and the *Theory of functions of complex variables.* In the meantime, he published his first papers: *Mapping space as symmetry in a hollow glass sphere* and *On altitudes of a triangle in hyperbolic geometry*, both in *Glasnik Mat.-Fiz. Astron*. Both papers were on geometry, more professional than purely scientific, and then the paper (14) on algebra in German, also in *Glasnik*.

je knjige napisali 1930-ih ljetujući u Hrvatskoj, u Makarskoj.

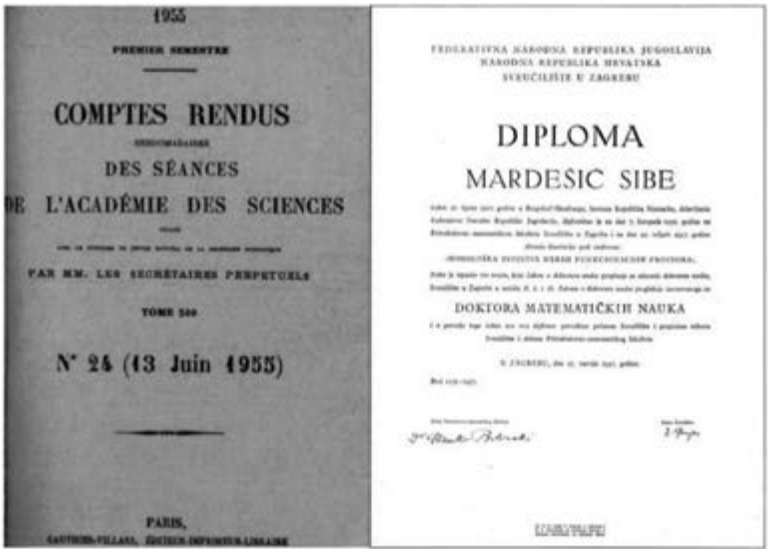
Uslijedilo je nekoliko članaka iz algebre i opće topologije objavljenih također u *Glasniku*, jedan zajedno s prof. Pavlom Papićem (16). Sredinom 1950-ih Mardešić je u poljskom časopisu *Fundamenta Mathematicae* pronašao zanimljiv članak Karola Borsuka o homološkim svojstvima nekih funkcionalnih prostora (17). Kao konačni ishod istraživanja, Mardešić je dokazao da ako je X metrički kompakt dimenzije k, onda za prostor neprekidnih preslikavanja sa X u m-sferu, $k<m$, vrijedi da mu je $(m-k)$-ta homologija izomorfna k-toj kohomologiji samog prostora X i da se pritom može uzeti singularna homologija, što je do tada bilo nepoznato. Nakon što je objavio četiri kraće najave svojih istraživanja u *Comptes Rendus* Francuske akademije (slika 3) i opsežni članak na 73 stranice u *Glasniku* (18), profesor Marković je smatrao da s tim materijalom Sibe može doktorirati. Obranio je doktorat 22. veljače 1957. s temom *Homološka svojstva nekih funkcionalnih prostora* (**slika 3**) na gotovo 180 stranica, pred povjerenstvom u sastavu Ž. Marković, Đ. Kurepa i S. Bilinski, u zamjeni P. Papić.

Već je 1956. Sibe Mardešić bio pozvan na *4. kongres rumunjskog saveza matematičara* (**slika 4**), gdje je govorio o svojim novim rezultatima istraživanja. Pritom je osobno upoznao brojne poznate topologe i s njima izmijenio iskustva korisna za daljnji rad; među ostalima, to su bili K. Borsuk, K. Kuratowski, S. Eilenberg, G. de Rham, L. Vietoris, K. Sitnikov, A. H. Stone, W. T. Wu, te Rumunji S. Stoilow,

However, in those years, at the suggestion of Ž. Marković, Sibe started thoroughly studying the book *Topologie* (in German) by H. Seifert and W. Threlfall (15), and a little later he studied the books on algebraic topology by the authors: S. Lefschetz, S. Eilenberg and N. Steenrod and P. Aleksandrov and H. Hopf. Interestingly, Seifert told him many years later that they wrote the major part of their book in the 1930s while vacationing in Croatia, in Makarska.

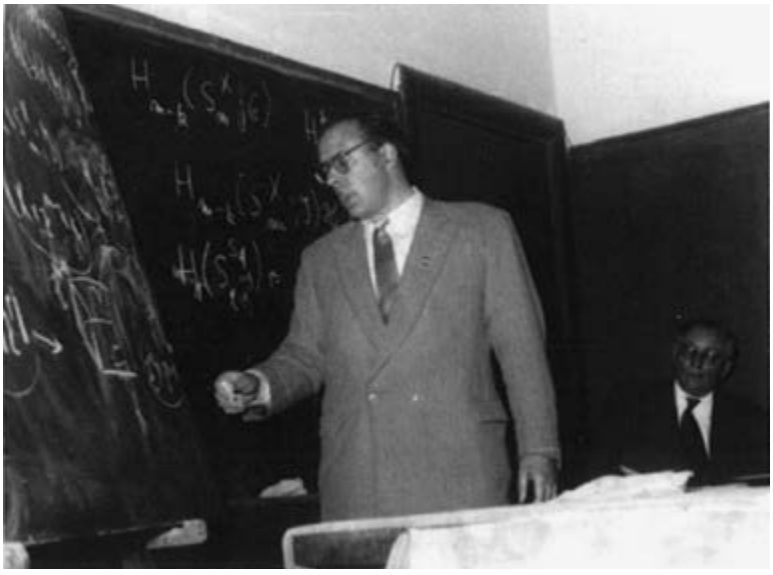
Several articles from algebra and general topology followed, also published in *Glasnik*, one together with prof. Pavle Papić (16). In the mid-1950s, Mardešić found an interesting article by Karol Borsuk on the homology properties of some functional spaces in the Polish journal *Fundamenta Mathematicae* (17). As the final result of the research on this topic, Mardešić proved that if X is a metric compact dimension k, then the space of all maps from X to the m-sphere, $k< m$, then the $(m-k)$-th homology of this space is isomorphic to the k-th cohomology of X and this can be considered in singular homology, which was unknown at that time. After publishing four short announcements of his research in the *Comptes Rendus* of the French Academy (**Figure 3**) and an extensive 73-page article in *Glasnik* (18), Professor Marković considered all these to be quite adequate material for Sibe to get his doctorate. He defended his doctorate on February 22, 1957, with the topic *Homological properties of some functional spaces* (**Figure 3**) about almost 180 pages, in front of a committee composed of Ž. Marković, Đ. Kurepa and S. Bilinski, replaced by P. Papić.

Already in 1956, Sibe Mardešić was invited to the *4th Congress of the* Romanian *Association of Mathematicians* (**Figure 4**), where he spoke about his new research results. There he personally met numerous famous topologists and exchanged expe-



SLIKA 3. ***Comptes rendus*, Francuske akademije, 1955. (lijevo) i doktorska diploma Sibe Mardešića, Zagreb, 1957. (desno) (1, str. 49)**

FIGURE 3. **Comptes rendus*, French Academy, 1955 (left) and doctoral diploma of Siba Mardešić, Zagreb, 1957 (right) (1, p. 49)***



SLIKA 4. **Mardešićevo prvo predavanje u inozemstvu, Bukurešt, 1956. (1, str. 47)**

FIGURE 4. ***Mardešić's first lecture abroad, Bucharest, 1956 (1, p. 47)***

G. Vranceanu, I. Bucur, T. Ganea, I. Berstein i drugi. Nakon novih spoznaja iz Rumunjske, napisao je članak za *Fundamenta Mathematicae* (19), u kojem je poopćio rezultate iz disertacije.

Nakon par pisama (bez interneta!) izmijenjenih s profesorom Solomonom Lefschetzom, predložio je Mardešiću da provede neko vrijeme na studijskom boravku na *Institute of Advanced Study* u Princetonu, tada (a i sada) jednom od najprestižnijih svjetskih matematičkih instituta. Uz preporuke kolega koje je sreo u Rumunjskoj te profesora Vilima (Williama) Fellera (1906. – 1970.), inače Zagrepčanina i tada redovitog profesora na Sveučilištu Princeton[1] dobio je odobrenje za studijski boravak u Americi. Nakon dosta peripetija oko dobivanja izlazne i ulazne američke vize, na put je krenuo 18. kolovoza 1957. teretnim brodom *Vojvodina* od Rijeke do New Yorka, koji je trajao 26 dana. U messinskom su tjesnacu putnici uz pomoć kapetana i mornara bacili u more zapečaćene boce s pismima obiteljima. Na sreću, supruga Vera je u Splitu dosta brzo primila Sibino pismo iz boce!

Nakon nekog vremena upoznavanja s Institutom i uklapanja u „američki način života" Sibe se priviknuo na život i rad u SAD-u. Brojni su europski znanstvenici Židovi (a i ne-Židovi) 1930-ih i 40-ih pred naletom nacizma našli utočište u Americi, naročito u Princetonu, primjerice Albert Einstein (koji je tamo i umro 1955.), John von Neumann (koji je također tamo umro 1957.), Hermann

[1] O Felleru vidi knjigu D. Žubrinića (20).

riences with them useful for further work; among others, they were K. Borsuk, K. Kuratowski, S. Eilenberg, G. de Rham, L. Vietoris, K. Sitnikov, A. H. Stone, W. T. Wu, and the Romanians S. Stoilow, G. Vranceanu, I. Bucur, T. Ganea, I. Berstein and others. After new knowledge from Romania, he wrote an article for *Fundamenta Mathematicae* (19), in which he summarized the results of the dissertation.

After a couple of letters (without the Internet!) exchanged with professor Solomon Lefschetz, he suggested that Mardešić spend some time on a study stay at the *Institute of Advanced Study* in Princeton, then (and now) one of the world's most prestigious mathematical institutes. With the recommendations of colleagues, he met in Romania, and professor Vilim (William) Feller (1906–1970), a native of Zagreb and then a full professor at Princeton University[1], he got approval for a study stay in the USA. After a lot of vicissitudes regarding obtaining an exit and entry American visa, he set off on August 18, 1957, on the cargo ship *Vojvodina* from Rijeka to New York, which lasted 26 days. Inside the Strait of Messina, passengers, with the help of captains and marines, threw closed bottles with letters to their families into the sea. Luckily, Sibe's spouse Vera got his letter from the bottle quite quickly in Split!

After some period of accommodation into the „American way of living", Sibe adapted to the Institute and to living and working in the USA. Numerous European Jewish (and non-Jewish) scientists in the 1930s and 40s before the assault of Nazism emigrated to the USA, especially in Princeton, for example, Albert Einstein (who died there in 1955), John von Neumann (who also died there in 1957), Hermann Weyl, Kurt Gödel and others. But the

[1] O Felleru vidi knjigu D. Žubrinića (20).

Weyl, Kurt Gödel i dr. No također su stalni članovi Instituta bili i poznati američki matematičari Oswald Veblen, James W. Alexander, Marston Morse, Hassler Whitney, John Milnor, Andre Weil, Armand Borel, Atle Selberg, Jean Leray, John F. Adams, Morris Hirsch i drugi. Tu se Sibe Mardešić posebno sprijateljio s njemačkim topolozima Albrechtom Doldom i Dieterom Puppeom iz Heidelberga, inače studentima H. Seiferta, čiju je knjigu *Topologie* Mardešić pomno proučavao. Susreo se tu i s Brankom Grünbaumom (1929. – 2018.) kojeg je poznavao još iz Zagreba jer je taj osječki Židov započeo studij matematike 1947. u Zagrebu, a već je 1949. sa zaručnicom Zdenkom emigrirao u Izrael (3). Od 1965. bio je profesor u Seattleu, Wa., SAD, geometar svjetskoga glasa, s kojim se Mardešić družio u Seattleu godinama kasnije.

Na elitnom Sveučilištu Princeton bilo je također iznimnih svjetskih matematičara i fizičara u to doba. Tamo je S. Mardešić pohađao predavanja (i seminare) topologa J. C Moorea iz algebarske topologije, R. H. Foxa iz teorije uzlova, N. Steenroda o kohomološkim operacijama, J. Milnora o diferencijalnoj topologiji i karakterističnim klasama te G. Whiteheada o teoriji homotopije. Pohađao je i *Topološki seminar* i tu upoznao i slušao neke čuvene matematičare-goste kao S. MacLane, S. Eilenberg, H. Cartan, S. Chern, R. Bott, A. Grothendieck, E. Spanier i mnogi drugi. Na Princetonu, na kojem je boravio 1957. – 1959., izbrusio je svoja znanja koja je uglavnom stekao kao samouk, dobio mnoge zamisli za nove radove, stekao

well-known American mathematicians Oswald Veblen, James W. Alexander, Marston Morse, Hassler Whitney, John Milnor, Andre Weil, Armand Borel, Atle Selberg, Jean Leray, John F. Adams, Morris Hirsch and some others were also full members of the Institute at that time. There, Sibe Mardešić became good friends with the German topologists Albrecht Dold and Dieter Puppe from Heidelberg, students of H. Seifert, whose book *Topologie* Mardešić studied in detail. There he also met Branko Grünbaum (1929–2018), whom he knew from Zagreb, because this Osijek Jew started studying mathematics in Zagreb in 1947, and already immigrated to Israel in 1949 with his fiancée Zdenka. (3) From 1965 he was a professor in Seattle, Wa., USA, and a world-renowned geometer, with whom Mardešić became friends in Seattle years later. At the elite Princeton University, there were also some well-known mathematicians and physicists at that time. There, S. Mardešić audited lectures (and seminars) given by topologist J. C. Moore from algebraic topology, lectures on knot theory by R. H. Fox, lectures on cohomology operations by N. Steenrod, differential topology and characteristic classes by J. Milnor and on homotopy theory by G. Whitehead. He also attended the *Topological Seminar* and there he met and listened to some top guest mathematicians delivering lectures such as S. MacLane, S. Eilenberg, H. Cartan, S. Chern, R. Bott, A. Grothendieck, E. Spanier and many others. At Princeton, he spent from 1957 to 1959 and bettered his knowledge, which he mostly acquired as a self-taught student, got many ideas for new works, gained enormous new experience and new colleagues and friends, topologists and mathematicians in general, and some physicists as well as Paul Dirac, Eugen Wigner and many more. However, it was important experience to see at Princeton how to organize postgraduate studies and scientific seminars.

golemo novo iskustvo i nove kolege i prijatelje topologe i uopće matematičare, pa i neke fizičare kao Paula Diraca, Eugena Wignera i druge. No, važno je istaknuti da je na Princetonu stekao iskustvo kako organizirati poslijediplomski studij i znanstvene seminare (kružoke).

Docent, profesor, Seattle, Heidelberg, prvi udžbenik

To se razdoblje Mardešićeva života odnosi otprilike na godine 1959. – 1976. Do 1960. Sibe Mardešić objavio je više izvornih radova u prestižnim časopisima kao što su *Trans. Amer. Math. Soc., Illinois J. Math., Michigan Math. J., Glasnik Mat.-Fiz.-Astr., Rad JAZU, Proc. Amer. Math. Soc.* Potpuni bibliografski podatci su u literaturi (2). Njegova tri sažetka predavanja sa sastanaka AMS mogu se naći u *Notices AMS*, prosinac, 1958. U to je doba (1960.) dokazao tzv. *teorem o faktorizaciji* (22). Taj teorem kaže da se svako (neprekidno) preslikavanje među Hausdorffovim kompaktnim prostorima može profaktorizirati kroz preslikavanje na metrički kompakt sa svojstvom da ako je dimenzija domene najviše n, onda je i taj kompakt dimenzije najviše n a njegova je težina najviše jednaka težini kodomene. Glavna je ideja dokaza da je svaki Hausdorffov kompaktni prostor dimenzije (prekrivanja) najviše n limes nekog inverznog sustava metričkih kompakata čiji svaki član ima dimenziju najviše n. Kako je svaki metrički kompakt limes inverznog niza poliedara, slijedi da je takav prostor dvostruki limes inverznih sustava poliedara.

Docent, professor, Seattle, Heidelberg, the first textbook

This period of Mardešić's life refers approximately to the years 1959–1976. In that period, till 1960, Sibe Mardešić published several original papers in world prestigious journals such as *Trans. Amer. Math. Soc*., *Illinois J. Math*., *Michigan Math. J*., *Glasnik Mat.-Phys.-Astr*., *Rad JAZU*, *Proc. Amer. Math. Soc.*

Complete bibliographic data are in the references (2). His three abstracts of lectures from American Mathematical Society (AMS) meetings can be found in the issue of *Notices AMS*, December 1958. At that time (1960), he proved the so-called *factorization theorem* (22). This theorem states that any (continuous) mapping between Hausdorff compact spaces can be factorized by a map to a metric compact such that its dimension is at most n if the domain has dimension at most n and its weight is at most the weight of the codomain of the mapping. The main idea of the proof is that any Hausdorff compact space of (covering) dimension at most n is the limes of an inverse system of metric compacts whose each member has dimension at most n. Since any metric compact is the limes of an inverse system of polyhedra, it follows that such a space is the double limes of inverse systems of polyhedra each dimension at most n (this is called the *developing theorem*). According to Mardešić himself: „The factorization theorem is probably the most important theorem that I have proved in my mathematical career". (1, p. 65). This theorem is still actually debated today.[2]

After his return to Zagreb from Princeton in mid-May 1959 and his habilitation lecture on July 9, 1959 entitled *On Homology Groups*, the process

[2] See e.g., M. G. Charalambous: *Dimension Theory*, Springer Nature, Switzerland AG, 2022.

ra svaki dimenzije najviše n (to je *teorem o razvoju*). Prema riječima samog Mardešića: „Teorem o faktorizaciji vjerojatno je najvažniji teorem koji sam dokazao u svojoj matematičkoj karijeri" (1, str. 65). O tome se teoremu razglaba i danas.[2]

of Mardešić's election as an assistant professor began on March 28, 1960 (**Figure 5**).

Two years later, Sibe Mardešić became an associate professor, and on June 30, 1966, a full professor at the Department of Mathematics of the Faculty of Science, University of Zagreb. Already in June

SLIKA 5. **Proslava Mardešićeve docenture u Zagrebu, 1960.: sjede (slijeva) prof. S. Bilinski, činovnica M. Galeković, knjižničarka N. Hofman, S. Mardešić i E. Vernić; stoje D. Palman, V. Sedmak, S. Kurepa, R. Draščić, G. Lukšić, K. Horvatić i P. Papić (1, str. 82)**

FIGURE 5. ***Celebration of Mardešić's assistant professorship in Zagreb, 1960: seated (from left) prof. S. Bilinski, clerk M. Galeković, librarian N. Hofman, S. Mardešić and E. Vernić; standing D. Palman, V. Sedmak, S. Kurepa, R. Draščić, G. Lukšić, K. Horvatić and P. Papić (1, p. 82)***

Nakon povratka u Zagreb iz Princetona sredinom svibnja 1959. i habilitacijskog predavanja 9. srpnja 1959. pod naslovom *O grupama homologije*, započeo je postupak Mardešićeva izbora za docenta, 28. ožujka 1960. (**slika 5**).

1960, he visited the universities of Heidelberg and Bonn (topology meeting known as the *Hirzebruch Tagung*) and the famous ETH in Zürich, where the *Differentialgeometrie und Topologie* conference was held with the world *„cremé de la cremé"* of topology at the time: J. F. Adams, M. Atiyah, P. S. Aleksandrov, A. Borel, R. Bott, W. Browder, S. Chern, P. J. Hilton, F. Hirzebruch, I. M. James, J. Leray, J. Milnor, S. Smale, N. E. Steenrod, R. Thom, C. T. C. Wall, H. Whitney and host Heinz Hopf. On that

[2] Vidi npr., M. G. Charalambous: *Dimension Theory*, Springer Nature, Switzerland AG, 2022.

Dvije godine kasnije Sibe Mardešić izabran je za izvanrednoga, a 30. lipnja 1966. za redovitoga profesora na Matematičkom odsjeku (tada odjelu) PMF-a Sveučilišta u Zagrebu. Već u lipnju 1960. posjetio je sveučilišta u Heidelbergu i Bonnu (sastanak topologa poznat kao *Hirzebruch Tagung*) te čuveni ETH u Zürichu na kojem se održavala konferencija *Differentialgeometrie und Topologie,* gdje se okupila svjetska *„cremé de la cremé"* tadašnje topologije: J. F. Adams, M. Atiyah, P. S. Aleksandrov, A. Borel, R. Bott, W. Browder, S. Chern, P. J. Hilton, F. Hirzebruch, I. M. James, J. Leray, J. Milnor, S. Smale, N. E. Steenrod, R. Thom, C. T. C. Wall, H. Whitney i domaćin Heinz Hopf. S. Mardešić je na toj miniturneji održao predavanja *The Hahn-Mazurkiewicz theorem for non-metric spaces* te *On homology local connectedness*. U srpnju 1961. na poziv Aleksandrova, Mardešić odlazi u tadašnji SSSR na *4. svesavezni matematički kongres*, u Lenjingradu (sadašnji Sankt Peterburg). Nakon trodnevna putovanja vlakom Zagreb – Beograd – Budimpešta – Kijev – Moskva, gdje je ostao cijeli dan u razgledavanju Kremlja, Crvenog trga s hramom Vasilija blaženoga, Lenjinova mauzoleja i Sveučilišta Lomonosov. Na konferenciji je održao predavanje na ruskom, uz pomoć kolege Rajka Draščića 1923. – 1972.)[3], asistenta s Geometrijskoga zavoda na studijskom boravku u Moskvi. Mardešić je održao predavanje

[3] D. Veljan: *Hrvatska matematika, teorija relativnosti i osvrt na Rajka Draščića*, Prirodoslovlje **19**(1-2) (2019) 3–21.

mini-tour, S. Mardešić provided lectures on *The Hahn-Mazurkiewicz theorem for non-metric spaces* and *On the homology of local connectedness.* On July 1961, at the invitation of Aleksandrov, Mardešić went to the then-USSR to attend the *4th All-Union Mathematical Congress*, in (former) Leningrad (now Saint Petersburg). After a three-day trip by train from Zagreb–Belgrade–Budapest–Kyiv–Moscow, he spent the whole day sightseeing the Kremlin, Red Square with the temple of St. Basil the Blessed, Lenin's Mausoleum and Lomonosov University.

At the conference he delivered a lecture in Russian, with a little help from his colleague Rajko Draščić (1923–1972)[3], an assistant at the Geometry seminar in Zagreb, then at graduate study in Moscow. Mardešić lectured on *Kontinuumy svjaznie posredstvom uporjadočennyh kontinuumov*. There he met Soviet (mainly Russian) topologists V. G. Boltyansky, M. F. Bukhštaber, L. V. Kel'disheva, V. Rohlin, L. Pontryagin, and the younger A. V. Arkhangel'sky, B. A. Pasynkov, as well as some Georgian, Armenian and other topologists.

In the school year 1959/60 Mardešić started to teach the subject *Mathematical Analysis II*, to second-year students at the Department of Mathematics of PMF, which was entrusted to him after habilitation by prof. Ž. Marković. He also started teaching the non-obligatory subject of *Combinatorial Topology and its Applications* for fourth-year students. In the year 1960/61 S. Mardešić, based on his experiences in the USA, introduced the postgraduate study of mathematics, the study of III. degree. In the same year, he also introduced the first postgraduate course of the *Topology Seminar* and delivered the first seminar titled *Topological Groups.*

[3] D. Veljan: *Hrvatska matematika, teorija relativnosti i osvrt na Rajka Draščića*, Prirodoslovlje **19**(1-2) (2019) 3–21.

Kontinuumy svjaznie posredstvom uporjadočennyh kontinuumov. Tu je upoznao sovjetske (uglavnom ruske) topologe V. G. Boltjanskoga, M. F. Buhštabera, L. V. Kel'diševu, V. Rohlina, L. Pontrjagina, i mlađe A. V. Arhangel'skoga, B. A. Pasynkova, kao i neke gruzijske, armenske i druge topologe.

Šk. god. 1959./1960. Mardešić je počeo predavati predmet *Matematička analiza II,* za studente druge godine Matematičkog odjela PMF-a kojeg mu je nakon habilitacije povjerio prof. Ž. Marković. Počeo je predavati i neobvezatni predmet *Kombinatorna topologija i njene primjene* za studente četvrte godine. Šk. god. 1960./1961. S. Mardešić je, temeljem iskustava u SAD-u, uveo poslijediplomski studij matematike, studij III. stupnja. Te je godine održao i prvi poslijediplomski kolegij *Topološke grupe*, a osnovan je i *Seminar za topologiju.* Mardešić je bio voditelj poslijediplomskoga studija matematike od 1960. do 1971. Tako je započela tzv. *Zagrebačka škola.* Zapravo, Zagrebačku školu ugrubo čini lanac: Varićak–Bilinski, Janković, Cesarec, Marković, Feller, Blanuša, Đ. Kurepa, Papić–Mardešić, S. Kurepa, Z. Janko (1932. – 2022.) i mlađi. Oko pokretanja toga studija osim Mardešića, znatnu su ulogu imali i profesori Svetozar Kurepa (1929. – 2010.), Vladimir Devidé (1925. – 2010.) i Pavle Papić (1919. – 2005.). Mardešić je tijekom karijere održao ukupno 13 poslijediplomskih kolegija u Zagrebu.

Godine 1963. Sibe Mardešić preuzima uredništvo časopisa *Glasnik Mat.-Fiz.-Astr.,* koji je 1966. preimenovan u *Gla-*

Mardešić was the head of the postgraduate study of mathematics from 1960 to 1971. This is how began the so-called *Zagreb School*. In fact, the *Zagreb School* roughly consists of a chain: Varićak–Bilinski, Janković, Cesarec, Marković, Feller, Blanuša, Đ. Kurepa, Papić–Mardešić, S. Kurepa, Z. Janko (1932–2022) and younger. In starting this study, besides from Mardešić, professors Svetozar Kurepa (1929–2010), Vladimir Devidé (1925–2010) and Pavle Papić (1919–2005) also played a significant role. During his career, Mardešić lectured in a total of 13 postgraduate courses in Zagreb.

In 1963, Sibe Mardešić took over the editorship of the journal *Glasnik Mat.-Fiz.-Astr.*, which was renamed *Glasnik matematički* in 1966. Under his editorship until 1976, *Glasnik* became a respected international mathematical journal. Let's mention that in 1964/65 Mardešić was vice-dean of PMF, and the following school year a guest professor at the University of Washington in Seattle, Wa., USA. In 1965, he received the Ruđer Bošković Republic Award for his scientific and professional work (**Figure 6**).

In Seattle, Mardešić lectured undergraduate courses *Calculus* and *Number Theory* and the *Continuum Theory* at the postgraduate level. There he started a scientific collaboration and lifetime friendship with Jack Segal; together they wrote five common papers published for instance in Trans. *Amer. Math. Soc*. (23) and *Michigan Math. J.* (24). Their best-known and most-cited paper in two parts, *ε-Mappings and Generalized Manifolds*, was published in 1967 in *Michigan Math. J.* (24).

In August 1968, Mardešić was invited to the international scientific conference *Topology and its Applications* (25) in Herceg Novi, Montenegro, where he gave a lecture on locally connected continua without real locally connected subcontinua.

The Polish mathematician Karol Borsuk (1905–1982) gave a lecture on the shape of (met-

snik matematički. Pod njegovim uredništvom do 1976. *Glasnik* je postao ugledan međunarodni časopis. Spomenimo da je 1964./1965. Mardešić bio prodekan PMF-a, a sljedeće školske godine gostujući profesor na Sveučilištu Washington u Seattleu, Wa., SAD. Za svoj znanstveni i stručni rad dobio je 1965. republičku nagradu *Ruđer Bošković* (**slika 6**).

U Seattleu je Mardešić, osim predavanja *Calculusa* i *Teorije brojeva* na dodiplomskom studiju, predavao *Teoriju kontinuuma* na poslijediplomskom studiju. Znanstveno se tu sprijateljio s Jackom Segalom; zajedno su napisali pet članaka, objavljenih u primjerice u *Trans. Amer. Soc* (23) i *Michigan Math. J.* (24). Najpoznatiji i najcitiraniji zajednički članak u dva dijela *ε-mappings and generalized manifolds* objavljen je 1967. u *Michigan Math. J.* (25).

U kolovozu 1968. Mardešić je pozvan na međunarodni znanstveni skup (konferenciju) *Topology and its Applications* (25) u Herceg Novom u Crnoj Gori, gdje je održao predavanje o lokalno povezanim kontinuumima bez pravih lokalno povezanih podkontinuuma. Poljski matematičar Karol Borsuk (1905. – 1982.) održao je predavanje o obliku (metričkih) kompakata, i tu se Mardešić susreo s pojmom *teorija oblika (shape theory*), čime će se znanstveno najviše baviti do kraja života. Teorija oblika je, grubo rečeno, izvjesna globalna teorija homotopije. Borsukov glavni primjer, koji je on prvi prikazao je tzv. Varšavska kružnica (jer je Borsuk iz Varšave), koja je istog „oblika" kao obična kružnica, no nisu homotopne, ne mogu ric) compacts, and there Mardešić encountered for the first time the concept of the shape theory. On that scientific topic he mostly spent the rest of his life. The shape theory is, roughly speaking, a certain global theory of homotopy. Borsuk's main example, which he first demonstrated publically is the so-called Warsaw Circle (because Borsuk is from Warsaw), which has the same „shape" as an ordinary circle, but not the same homotopy type because they cannot be continuously deformed into each other (**Figure 7**).

SLIKA 6. **Godine 1965. Mardešić je dobio Republičku nagradu za znanstveni rad s likom *Ruđera Boškovića* (naličje, lijevo i lice, desno)**

FIGURE 6. ***In 1965 Mardešić received the Croatian scientific Ruđer Bošković medal (back side, left and face, right)***

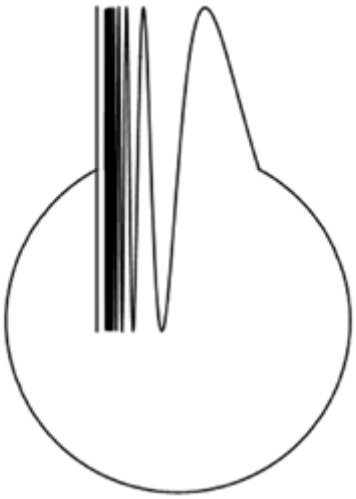
Just as in analysis, an „ugly" function tries to be approximated by polynomials (nice functions) so in topology „ugly" spaces are tried to be approximated by „good" spaces such as polyhedra. Mardešić already had the basic idea from the factorization theorem. He reached the polyhedra into the game by the concept of the nerve of an open cover of the compact Hausdorff space, i.e. the simplicial complex whose *k*-simplexes correspond to the *k*-sets of members of open cover with non-empty intersection. The body of that simplicial complex is a polyhedron. At the aforementioned meeting, S.

se neprekidno deformirati jedna u drugu (**slika 7**).

Kao što se u analizi „ružna" funkcija aproksimira polinomima sve većeg i većeg stupnja (iz Taylorovog razvoja), tako se u topologiji „ružni" prostori nastoje aproksimirati „dobrim" prostorima-poliedrima. Osnovnu je ideju Mardešić već imao iz teorema o faktorizaciji. Do poliedara je došao preko nerva otvorenog pokrivača kompaktnoga Hausdorffovog prostora, tj. simplicijalnoga kompleksa čiji k-simpleksi odgovaraju k-torki članova pokrivača koji imaju neprazan presjek. Tijelo toga simplicijalnoga kompleksa je poliedar. Na spomenutom je sastanku S. Mardešić predložen za člana savjeta novo osnovanog časopisa *Topology and its Applications* (prvotno *General Topology and its Applications*). U tom će časopisu godinama objavljivati brojne članke, a posljednji 2015. (26). U svojoj knjizi (1, str. 135), Mardešić navodi da je konferenciju zasjenila sovjetska invazija Čehoslovačke! Osim toga, A. Dold je pozvao u Heidelberg Jacka Segala i Sibu Mardešića, koji su dogovorili da Segal kasnije provede studijsku godinu u Zagrebu.

U rujnu 1968. su Mardešić i Segal pozvani na konferenciju u Bukureštu, gdje je Mardešić održao predavanje *Inverse limits of ANR's and generalized manifolds* na kojemu su nazočili neki poznati topolozi kao W. Browder, L. Siebenmann, C. T. C. Wall, ali su mnogi rumunjski topolozi već odavno emigrirali uglavnom u SAD, primjerice I. Berstein, D. Burghelea, A. Deleanu, T. Ganea. Mardešić spominje kako se na tom znanstvenom skupu također osje-

Mardešić was proposed as a member of the Board of executive editors of the newly established journal *Topology and its Applications* (previous name *General Topology and its Applications*). In this journal S. Mardešić published many papers over the years, the last one in 2015 (26). In his book (1, p. 135), Mardešić states that the conference was overshad-



SLIKA 7. **Varšavska kružnica Karola Borsuka**
FIGURE 7. ***Karol Borsuk's Warsaw circle***

owed by the possible Soviet invasion of Czechoslovakia! In addition, A. Dold invited Jack Segal and Sibe Mardešić to Heidelberg, who arranged for Segal to spend an academic year in Zagreb.

In September 1968, Mardešić and Segal were invited to a conference in Bucharest, where Mardešić gave a lecture on *Inverse limits of ANR's and generalized manifolds*, which was attended by some well-known topologists such as W. Browder, L. Siebenmann, C. T. C. Wall. But many Romanian topologists already emigrated abroad, mainly to the USA, for instance, I. Berstein, D. Burghelea, A. De-

ćala tjeskoba i strah da bi sovjetske trupe mogle svakog časa ući u Rumunjsku!

Šk. god. 1969./1970. Segal provodi u Zagrebu kao gostujući profesor i predaje poslijediplomski predmet *Introduction to algebraic topology* (kojega je kao dodiplomski student odslušao i autor ovog članka; Mardešićevi su kolegiji bili puno „sočniji“). Mardešić i Segal nastavljaju raditi na teoriji oblika, objavljuju tri članka, a najcitiraniji je *Shapes of compacta and ANR systems* (27), koji je Mardešićev najcitiraniji članak citiran 192 puta do 2022. prema bazi podataka Google Scholar. U tome su članku uspjeli proširiti kategoriju oblika na kompaktne Hausdorffove prostore. Krajem lipnja 1970., Mardešić je na PMF-u u Zagrebu organizirao *Ljetnu školu za topologiju* i pozvao desetak predavača iz SAD-a i Njemačke, a kao slušače četrdesetak polaznika iz čitave tadašnje države.

Šk. god. 1971./1972. Mardešić je gostujući profesor u Heidelbergu, jednom od najboljih njemačkih sveučilišta, posebice u matematici, gdje je predavao nekoliko predmeta i seminara na njemačkom jeziku. Te je godine napisao članak koji je objavljen 1973. u časopisu *General Topology Appl.* (28) u kojemu je uspio definirati kategoriju oblika Sh za bilo koje topološke prostore. Taj je članak također često citiran (oko 130 puta do 2022. prema bazi Google Scholar). Ubrzo je svoj opis kategorije Sh dao i Kiiti Morita iz Tokija poopćenjem Mardešić-Segalova rada s kompaktnoga na nekompaktni slučaj.

Već u zimskom semestru 1972./1973. Mardešić je proveo tri mjeseca u Pittsbur-

leanu and T. Ganea. Mardešić in his book (1) mentions also feeling at that scientific meeting – anxiety and fear that Soviet troops could enter Romania at any moment!

The academic year, 1969/70 Segal spent in Zagreb as a guest professor and lectured the course *Introduction to algebraic topology* (which the author of this article also took as an undergraduate student, but Mardešić's courses were much more „juicy“).

Mardešić and Segal continued to work on shape theory. They published three papers, and the most cited of which is *Shapes of compacta and ANR systems* (27), which is Mardešić's most cited paper, 192 times till 2022 according to the Google Scholar database. In this paper, the authors extended the category Sh of shapes for all topological spaces. At the end of June 1970, Mardešić organized a *Summer School for Topology* at the Faculty of Science in Zagreb and invited a dozen lecturers from the USA and Germany as well as 40 students from the entire country at the time.

In the school year 1971/72 Mardešić is a guest professor at Heidelberg, one of the best German universities, especially in mathematics, where he taught several math subjects and seminars in German. That year he wrote an important paper published in 1973 in the journal *General Topology Appl.* (28), where he defines a category of shapes Sh for any topological spaces. That paper is also often cited (about 130 times by 2022 according to the Google Scholar database). Soon after, Kiiti Morita from Tokyo also gave his description of the Sh category by generalizing Mardešić-Segal's work from the compact to the non-compact case.

Already in the winter semester of 1972/73 Mardešić spent three months in Pittsburgh, Pa., USA, where he was invited by professor Nagata. But before that, in June 1972, a large international conference on *Set Theory and Topology* was

ghu, Pa., SAD, na poziv profesora Nagate. No prije toga, u lipnju 1972. održana je u Keszthelyju na Blatnom jezeru u Mađarskoj velika međunarodna konferencija *Set Theory and Topology* na kojoj su sudjelovali mnogi eminentni mađarski matematičari kao P. Erdös, L. Lovász, I. Juhász, V. Sós-Turan i drugi, dosta američkih i europskih te popriličan broj hrvatskih, slovenskih i drugih matematičara. U Pittsburghu je 1972./1973. Mardešić predavao poslijediplomski predmet *Algebarska topologija* (tri sata tjedno) i u *Nagatinom seminaru* o teoriji oblika. U toj je godini Mardešić napisao više članaka objavljenih nešto kasnije u časopisu poljske akademije znanosti *Bull. Acad. Polon. Sci. Ser. Sci. Math. Astron. Phys.* (29), američkim *Trans. Amer. Math. Soc.* (30), *Proc. Amer. Math. Soc.* (31) i drugima. U njima je razrađivao ideje iz teorije oblika. Tu je naišao i na ideju koja se kasnije u nekim knjigama nazivala „Mardešićev trik" (katkad i „Deligne-Mardešićev trik"), a riječ je o tome da se svaki inverzni sistem može zamijeniti ekvivalentnim koji je indeksiran kofinitnim skupom, znači usmjerenim skupom u kojem svaki element ima samo konačno mnogo prethodnika (31).

Povratkom u Zagreb 1973., Mardešić počinje intenzivnije raditi na udžbeniku *Matematička analiza u* n*-dimenzionalnom realnom prostoru*. I. dio, namijenjen studentima matematike (32) izašao je 1974. (a nakon toga još tri izdanja do 1991.), a 1977. je izašao II. dio pod nazivom *Integral i mjera* (33) (nakon toga još dva izdanja).

held in Keszthely on the Mud Lake in Hungary, in which participated many eminent Hungarian mathematicians such as P. Erdös, L. Lovász, I. Juhász, V. Sós-Turan and others, quite a few American and European and a considerable number of Croatian, Slovenian and other mathematicians. In Pittsburgh in 1972/73 Mardešić taught the graduate course *Algebraic Topology* (three hours a week) and in *Nagata's seminar* a series of lectures on shape theory. During that year, Mardešić wrote several papers published a little later in the journal of the Polish Academy of Sciences, *Bull. Acad. Polon. Sci.*, *Ser. Sci. Math. Astron. Phys*. (29), in American *Trans. Amer. Math. Soc*. (30), Proc. Amer. Math. Soc. (30) and others. In these papers, he developed some details of the shape theory. There he came up with an idea that later in some books was called „Mardešić's trick" (sometimes also „Deligne-Mardešić's trick"), that any inverse system can be replaced by an equivalent system whose index set is cofinite, which means by the directed set where every element has only finitely many predecessors (31).

Returning to Zagreb in 1973, Mardešić started to work more intensively on his textbook *Mathematical analysis in* n*-dimensional real space*, Part I, intended for students of mathematics (32), and was published in 1974 (and then three more editions until 1991). In the year 1977, *Integral and measure*, Part II (33), was published (and two more editions after that).

At that time, S. Mardešić also „did" two important social activities. From 1971 to 1973, he was the president of the Society of Mathematicians and Physicists of Croatia, and after that, 1974/75 and 1975/76 he was dean of PMF. From 1970 to 1975, he was the vice president of the Union of Yugoslav Societies of Mathematicians, Physicists and Astronomers. At that time, the „famous" Šuvar school reform took place, so it was necessary to „save" what

U to je vrijeme S. Mardešić „odradio" i dvije važne društvene djelatnosti. Od 1971. do 1973. bio je predsjednik Društva matematičara i fizičara Hrvatske, a nakon toga šk. god. 1974./1975. i 1975./1976. bio je dekan PMF-a. Od 1970. do 1975. bio je potpredsjednik Saveza društava matematičara, fizičara i astronoma Jugoslavije. U to je doba nastala i „čuvena" Šuvarova reforma školstva, pa je trebalo „spasiti" za matematiku što se spasiti moglo. I tu je Mardešić učinio mnogo. Uza sve obveze 1975./1976. te 1976./1977. predavao je na Filozofskom fakultetu u Zadru matematiku studentima posebnog studija matematike i filozofije (podsjetimo, zadarsko je sveučilište najstarije hrvatsko sveučilište, osnovano 1396.; predavao je tamo matematiku oko 1500. i fra Luca Pacioli suradnik Leonarda da Vincija). I za osnutak studija matematike 1974. u Splitu zaslužan je profesor S. Mardešić. Svakom bi prilikom posjećivao svoje roditelje i svoj voljeni Split. Više je puta, šaleći se, kazao da je on „Splićanin na privremenom radu u Zagrebu". U lipnju 1975. Sibe Mardešić je izabran za izvanrednog člana JAZU (sada HAZU).

Od društvenih događanja valja spomenuti tzv. topološke izlete. Upravo je Sibe Mardešić još 1963. bio inicijator društvenih izleta grupe topologa autobusom u razna područja (Samobor, Karlovac, pa u Sloveniju, Istru, Bosnu, Vojvodinu, otok Krk i drugdje), sve do 1983. Obilazili bi crkve, manastire i razne spomenike kulture. Najzabavnije su bile vožnje autobusima, gdje je bilo viceva, smijeha, pjesme, igre „pantomima" itd. U duhovitim dosjetcould be saved for mathematics. And Mardešić did a lot of what was possible. Besides the obligations in 1975/76 and in 1976/77, he taught mathematics at the Faculty of Philosophy in Zadar to the students in the special study of mathematics and philosophy. (The University of Zadar is the oldest Croatian university, founded in 1396 and among the first that taught mathematics. Fra Luca Pacioli, Leonardo da Vinci's associate, taught mathematics there around 1500.) Professor S. Mardešić is also one of the founders of the Department of mathematics in 1974 in Split. At any opportunity, he visited his parents and his beloved Split. One of his legendary jokes was: „I am a Splitman temporarily employed in Zagreb". In June 1975, Sibe Mardešić was elected as an associate member of the Academy JAZU (today HAZU).

Among the social events, it is worth mentioning the so-called topological excursions. In 1963, Sibe Mardešić initiated the social trips of a group of topologists to visit various areas (Samobor, Karlovac, then Slovenia, Istria, Bosnia, Vojvodina, the island of Krk and elsewhere) until 1983. They would visit churches, monasteries and various cultural monuments. The most fun was the bus rides with many jokes, laughter, songs, a play of „pantomime" etc. The humorous jokes were made by legendary professors and Sibe's friends, professors Boris Pavković (1931–2006) (34) and Krešo Horvatić (1930–2008) (35), both obtained their master's degrees under S. Mardešić. Let us mention here that professor Pavković skilfully drew all the figures for Mardešić's books and was one of their correctors.

Professor Sibe Mardešić proved himself as a tireless and successful organizer of the International conference and course in 1976 in Dubrovnik, within the framework of the Interuniversity Center. He organized the *Shape theory and pro-homotopy* inter-

kama prednjačili su legendarni profesori i Sibini prijatelji profesori Boris Pavković (1931. – 2006.)(34) i Krešo Horvatić (1930. – 2008.) (35), koji su i magistrirali pod njegovim vodstvom. Ovdje valja spomenuti da je profesor Pavković vješto nacrtao sve slike za Mardešićeve knjige i sudjelovao u njihovim korekcijama.

Kao neumoran i sposoban organizator profesor Sibe Mardešić se iskazao i u organizaciji međunarodne konferencije i škole *Shape theory and pro-homotopy* 1976. u Dubrovniku u okviru Interuniverzitetskog centra – opširno o tome piše u (1). Bio je direktor skupa, okupio je 15-ak predavača i suradnika te 40-ak slušača. Osim Mardešića, hrvatski predavači bili su profesori K. Horvatić i Ivan Ivanšić (1931. – 2020.) (36), koji je često surađivao s Mardešićem u organizacijama znanstvenih skupova. Sličnih škola odnosno konferencija održano je u Dubrovniku još sedam za Mardešićeva života (1981., 1986., 1998., 2002., 2007., 2011. i 2015.), iako u tri posljednja Sibe više nije bio „glavni i odgovorni".

Utah, Kentucky, Oklahoma, Seattle, Japan

Tu je riječ o razdoblju otprilike 1977. – 1987., kada je profesor Sibe Mardešić možda najviše putovao. Prvo je zimski semestar šk. god. 1977./1978. proveo kao gostujući profesor u SAD-u na Sveučilištu Utah u Salt Lake Citiyju, a ljetni na Sveučilištu Kentucky u Lexingtonu. No i odatle je putovao u Provo, Seattle i druga mjesta. U to se doba zajedno s domaćinima

national conference and course and he described it in detail in his book (1). He was the director of the conference and invited about 15 lecturers and about 40 listeners. Apart from Mardešić, the Croatian lecturers were professors K. Horvatić and Ivan Ivanšić (1931–2020) (36), who often collaborated with Mardešić in the organization of scientific conferences. Seven more similar conferences and schools were held in Dubrovnik during Mardešić's lifetime (1981, 1986, 1998, 2002, 2007, 2011 and 2015), although in the last three Sibe was no longer the „main and responsible".

Utah, Kentucky, Oklahoma, Seattle, Japan

Here we are talking about the period approximately 1977–1987, when professor Sibe Mardešić perhaps traveled the most. First is the winter semester of the academic year 1977/78 spent as a guest professor in the USA at the University of Utah in Salt Lake City, and in the summer at the University of Kentucky in Lexington. But from there he also traveled to Provo, Seattle and other places. At that time he worked and collaborated with various domestic peoples on shape fibrations and published several articles and records about it, for example (37).

One of the greatest professional honors in his career that professor Sibe Mardešić experienced was when (while still in Salt Lake City) he was an „invited speaker" at the *World Mathematical Congress* in Helsinki in August 1978, i.e. an invited lecturer and gave a lecture for 45 minutes (*Shape theory*), which was published in the proceedings of the congress on eight pages (38). World mathematical congresses (ICM) are held every four years. Apart from Mardešić, only a few other Croatian mathematicians (so far) have been invited lecturers at world congresses. These are Vladimir Varićak

ma dosta bavio s fibracijama oblika i o tome objavio nekoliko članaka i zapisa, npr. (37)

Jedna od najvećih stručnih počasti u karijeri koju je profesor Sibe Mardešić doživio bilo je kad je (još u Salt Lake Cityju) pozvan da u kolovozu 1978. na Svjetskom matematičkom kongresu u Helsinkiju bude „Invited speaker", tj. pozvani predavač i održi predavanje od 45 minuta (*Shape theory*), koje je objavljeno u zborniku kongresa na osam stranica (38). Svjetski se matematički kongresi održavaju svake četvrte godine. Osim Mardešića, samo su još nekolicina hrvatskih matematičara (do sada) bili pozvani predavači na svjetskim kongresima. To su Vladimir Varićak (1865. – 1942.) (6) na kongresu u Rimu 1908., predavanje *Zur nicht euklidischen analytischen Geometrie*, Đuro Kurepa na kongresu u Amsterdamu 1954. predavanje *Uloga matematike i matematičara u današnjici* (na francuskom), te na kongresu u Edinburghu 1958. predavanje *Some principles of mathematical education*, Vilim Feller (plenarni predavač) na kongresu u Edinburghu 1958. predavanje *Some new connections between probability and classical analysis*, Zvonimir Janko (1932. – 2022.) na kongresu u Nici, Francuska, 1970., predavanje *Sporadic groups* te Mladen Bestvina (r. 1959.) na kongresu u Pekingu, Kina, 2002., s predavanjem *Group of outer automorphisms of a free group of rank n,* te na virtualnom kongresu u Helsinkiju 2022. predavanje *Groups acting on hyperbolic spaces – a survey*.

Poslije Helsinkija profesor Mardešić pozvan je na veliku 10-dnevnu konferen-

(1865–1942) (6) at the congress in Rome in 1908, the lecture *Zur nicht euklidischen analytischen Geometrie*, Đuro Kurepa at the congress in Amsterdam in 1954, the lecture *The Role of Mathematics and Mathematicians in Today* (in French), and at a congress in Edinburgh in 1958, the lecture *Some principles of mathematical education*, Vilim Feller (plenary lecturer) at the congress in Edinburgh in 1958, lecture *Some new connections between probability and classical analysis*, Zvonimir Janko (1932–2022) at the congress in Nice, France, 1970, lecture *Sporadic groups* and Mladen Bestvina (b. 1959) at the congress in Beijing, China, 2002, with the lecture *Group of outer automorphisms of a free group of rank n*, and at the virtual congress in Helsinki in 2022, the lecture *Groups acting on hyperbolic spaces – a survey*.

After Helsinki, professor Mardešić was invited to a large 10-day conference on geometric topology in Warsaw, Poland. There he completed an article with J. Keesling on shape fibrations published in *Pacific J. Math*. (39). The same school year Aleksandar Šostak from Riga was a guest professor in Zagreb (he obtained his Ph.D. at the Moscow State University, MGU). Mardešić and Šostak later published three common papers.

At that time, Mardešić also started to work with resolvents of spaces and mappings related to shape and independently published an article about it in 1981 in the *Fund. Math*. on 25 pages. (40) At the shorter topological conference at the V. A. Steklov Institute in June 1979 in Moscow, where Mardešić held a lecture on resolvents, he met Jurij Lisica and invited him to spend a year in Zagreb. Mardešić was sent from Moscow for three days to Tbilisi, Georgia, at the expense of the Soviet Academy of Science. That's when he started thinking about strong shape. After the USSR, from September 9, he spent a month at the University of L'Aquilla, Abruzzo

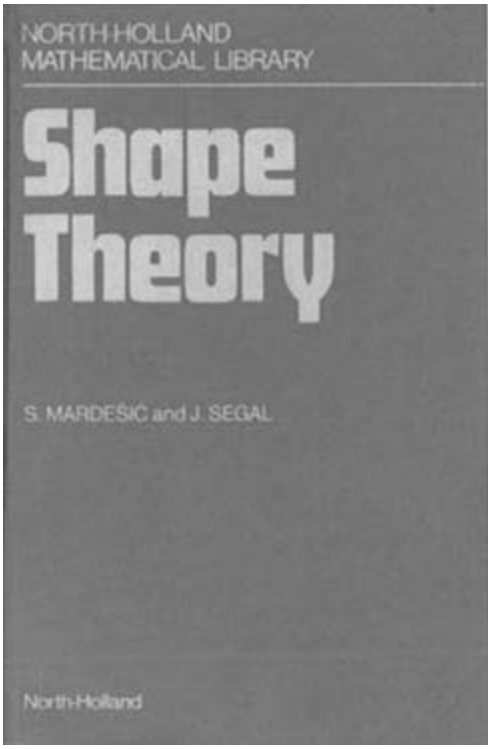
ciju iz geometrijske topologije u Varšavi u Poljskoj. Tu je dovršio članak s J. Keeslingom o fibracijama oblika objavljen u *Pacific J. Math.* (39). Te je školske godine u Zagrebu bio gost Aleksandar Šostak iz Rige, inače doktorand na MGU s kojim je S. Mardešić napisao tri rada.

U to se doba Mardešić počeo baviti i rezolventama prostora i preslikavanja vezano za oblike i o tome samostalno objavio članak 1981. u *Fund. Math.* na 25 stranica. (40) Na kraćoj topološkoj konferenciji Instituta V. A. Steklova u lipnju 1979. u Moskvi, gdje je Mardešić održao predavanje o rezolventama, dogovorili su dolazak Jurija Lisice u Zagreb na godinu dana. Iz Moskve je na trošak Sovjetske akademije Mardešić poslan na tri dana u Tbilisi, Gruzija. Tu je počeo razmišljati o jakom obliku. Nakon SSSR-a, od 9. rujna, mjesec je dana proveo na Sveučilištu L'Aquilla, provincija Abruzzo, gdje je na talijanskome održao niz od osam predavanja.

Godine 1982. izašla je u izdanju North Hollanda monografija S. Mardešića i J. Segala (41), često citirana u literaturi (oko 684 puta do 2022. prema bazi podataka Google Scholar), **slika 8**.

Uslijedila su kraća gostovanja u Sarajevu, Torinu, Beču i drugdje, svuda s predavanjima. Profesor Mardešić se počeo intenzivnije baviti teorijom *jakog oblika*, finijom od teorije oblika. Krajem ljeta 1981. Mardešić i supruga Vera putuju u Japan na Sveučilište Tsukuba. Nakon izvjesne prilagodbe japanskom načinu života, Mardešić predaje kolegije i širi svoja saznanja o Japanu, gdje se doktorat iz matematike može steći na samo deset sveučiprovince, where he gave a series of eight lectures in Italian.

In 1982, a monograph by S. Mardešić and J. Segal (41) was published by North Holland, often cited in the literature (about 684 times by 2022 according to the Google Scholar database), **Figure 8**.



SLIKA 8. **Naslovnica monografije *Shape Theory* S. Mardešića i J. Segala (41)**

FIGURE 8. ***Cover page of the monograph* Shape Theory *by S. Mardešić and J. Segal (41)***

This was followed by shorter guest appearances in Sarajevo, Torino, Vienna and elsewhere, with lectures everywhere. Professor Mardešić began to work more intensively on the strong shape theory, which is finer than the theory of shape. At the end of the summer of 1981, Mardešić and his wife Ve-

lišta, od kojih je sedam još od prije Drugoga svjetskog rata. (U knjizi (1) Mardešić navodi podatak da japanska djeca nakon devet godina učenja u školi svladaju 1 850 osnovnih znakova pisma *kanji,* te fonetsko slogovno pismo *katakana*.) Posebno ih se dojmio Kyoto, bivši glavni grad Japana (od 794. do 1868.), gdje su u jednom hramu, na veliko iznenađenje, naišli na akademika Vladimira Devidéa i njegovu japansku suprugu Yasuyo Hondo. U dva je mjeseca profesor Mardešić održao deset predavanja po Japanu.

U razdoblju 1981. do 1987. Mardešić se znanstveno uglavnom fokusira na teoriju jakog oblika koja je finija od obične teorije oblika i jake homologije koja je invarijantna na jaki oblik, a sve temeljeno na inverznim sustavima ANR-ova (apsolutnih okolinskih retrakata). Mardešić i Jurij Lisica u Zagrebu su na tu temu napisali sedam radova, a započeli su sa serijom od tri rada u *Glasniku* na više od 100 stranica (42) i nastavili u *Topology Appl.* te *Tsukuba J. Math.* (43)

Zanimljivo je spomenuti da ako preslikavanje među metričkim kompaktima inducira izomorfizam oblika, mora li inducirati i izomorfizam jakog oblika? I danas (50 godina poslije) to je otvoreno pitanje.

Poslije velike topološke konferencije 1982. u tadašnjem Lenjingradu (danas Sankt Peterburg), razgledavanja Ermitaža, Petro-dvoreca, gotovo svi sudionici došli su na groblje Aleksandra Nevskog na polaganje cvijeća na grob jednog od najvećih matematičara svih vremena, Švicarca Leonharda Eulera (1707. – 1783.) koji je služio na dvoru ruske carice Katarine

ra traveled to Japan to the University of Tsukuba. After some adaptation to the Japanese way of life, Mardešić taught courses and bettered his knowledge about Japan, where a doctorate in mathematics can be obtained at only ten universities, seven of which date back to before the World War II. [In the book (1), Mardešić states that after nine years of studying at school, Japanese children master 1,850 basic *kanji* characters and the phonetic syllabic *katakana* alphabet.] They were impressed by Kyoto, the former capital of Japan (from 794 to 1868), where, to their great surprise, they encountered academician Vladimir Devidé and his Japanese wife Yasuyo Hondo in a temple. In two months, professor Mardešić led ten lectures around Japan.

In the period from 1981 to 1987, Mardešić scientifically focuses mainly on the strong shape theory, which is finer than the ordinary shape theory, and strong homology, which is invariant to the strong shape, all based on inverse systems of ANRs (absolute neighborhhood retracts). Sibe Mardešić and Jurij Lisica wrote seven papers on this topic in Zagreb, and they started with a series of three papers in *Glasnik* on more than 100 pages (42) and continued in *Topology Appl.* and *Tsukuba J. Math.* (43)

It is interesting to mention that if a mapping among metric compacta induces a shape isomorphism, must it also induce a strong shape isomorphism? Even today (50 years later) it is an open question.

After the big topological conference in 1982 in Leningrad (today Saint Petersburg), sightseeing of the Hermitage, Petro-dvorec, almost all the participants came to the cemetery of Alexander Nevsky to lay flowers on the grave of one of the greatest mathematicians of all time, the Swiss Leonhard Euler (1707–1783) who served at the court of the Russian empress Catherine the Great. And his last in-

Velike. I posljednja slutnja mu se pokazala ispravnom, kad je rekao (pred desetak unučadi): sutra ću umrijeti. Euler je dokazao na stotine teorema, među ostalim (oko 1765.) ambijetalnu nejednakost $R \geq nr$, gdje su R i r polumjeri opisane i upisane kugle u n-dimenzionalnom simpleksu. Autor ovoga članka je 2021./2022. profinio tu nejednakost u vidu intrinsične nejednakosti ovisne o duljinama bridova simpleksa [(*J. Geom*., (44)] s primjenom na vjerojatnost u astrofizici.

Uslijedili su Mardešićevi kraći posjeti u Italiju, München, Atenu, proveo je mjesec i pol na Topološkom semestru u *Banach centru* u Varšavi, bio je na topološkom sastanku u Oberwolfachu, zatim krajem rujna 1984. u Madridu, a svibanj 1985. proveo je na Sveučilištu u Perugi. U međuvremenu je na nekoliko dana 1983. „skoknuo" u Skopje i tadašnji Titograd (danas Podgorica), a u rujnu 1985. na kongres u Prištinu, šest je dana u listopadu bio na konferenciji *Topology and its Applications* u Dubrovniku. Sibe Mardešić i Jože Vrabec iz Ljubljane bili su voditelji topološkog seminara *Zagreb-Ljubljana*, s četiri-pet godišnjih sastanaka. U travnju 1986. Mardešić je opet u L'Aquilli na konferenciji *Categorical Topology*, a potom u dva navrata u Beogradu gdje je održao niz od deset sati predavanja: *Osnovi teorije homotopije i oblika.* U lipnju kratko gostuje u Trstu, a u listopadu 1986. je u Dubrovniku održana 12-dnevna treća škola za teoriju oblika pod imenom *Geometric topology*, gdje su Mardešić i Segal bili direktori i urednici pripadnog zbornika objavljenog u renomiranoj Springe-

tuition turned out to be genuine when he said (in front of ten grandchildren): I will die tomorrow. Euler proved hundreds of theorems, among others (around 1765) the ambient inequality $R \geq nr$, where R and r are the radii of the circumscribed and inscribed spheres in the n-dimensional simplex. The author of this article in 2021/22 refined this inequality in the form of an intrinsic inequality depending on the lengths of the edges of the simplex [(J. Geom., (44)] with application to probability in astrophysics.

This was followed by Mardešić's shorter visits to Italy, Munich, Athens, he spent a month and a half at the *Topological Semester* at the *Banach Center* in Warsaw, and he was at a topological meeting in Oberwolfach, then at the end of September 1984 in Madrid, and he spent May 1985 at the University of Perugia. In the meantime, for a few days in 1983, he „jumped" to Skopje and Titograd (today Podgorica), and in September 1985 to a congress in Priština, and for six days in October he was at the *Topology and its Applications* conference in Dubrovnik. Sibe Mardešić and Jože Vrabec from Ljubljana were the leaders of the topology seminar *Zagreb-Ljubljana*, with four or five annual meetings. In April 1986, Mardešić was again in L'Aquilla at the *Categorical Topology* conference, and then on two occasions in Belgrade, where he held a series of ten-hour lectures: *Basics of homotopy and shape theory.* In June, he made a short visit to Trieste, and in October 1986, a 12-day third school for the theory of shapes called *Geometric topology* was held in Dubrovnik, where Mardešić and Segal were the directors and editors of the related proceedings published in Springer's renowned *Lecture Notes in Mathematics.*(45) A. Koyama, T. Watanabe and A. Prasolov spent several months in Zagreb working with Mardešić, which resulted in several papers, for instance (46, 47). At the end of October, he held

rovoj seriji *Lecture Notes in Mathematics* (45). U Zagrebu su više mjeseci zbog rada s Mardešićem proveli A. Koyama, T. Watanabe i A. Prasolov, što je rezultiralo s nekoliko zajedničkih članaka, npr. (46, 47). Krajem listopada održao je na susretima matematičara Graza i Zagreba predavanje *Strong shape and strong homology*.

Godine 1985./1986. kao Fulbrightov stipendist u Zagrebu je boravio profesor Leonard Rubin sa Sveučilišta Oklahoma u Normanu, Oklahoma, SAD, koji je imao ambicije raditi s Mardešićem, ali zbog majčine bolesti tek u veljači 1987. Mardešić kreće u Oklahomu pa onda u Seattle. Neumorni Sibe Maredšić nastavlja znanstveni rad sada s kolegom L. Rubinom na problemima tipa može li CE preslikavanje među metričkim kompaktima povisiti dimenziju. Neke pozitivne rezultate na tu temu su ubrzo objavili u *Pacific J. Math.* (48). Nakon Oklahome, gdje je i Vera Mardešić održala predavanje *Convex functions* u klubu studenata matematike, bračni par Mardešić leti opet u Seattle. Netom kako su stigli u Seattle, profesor Mardešić je po pozivu na konferenciju napravio mini turneju na jugoistok SAD-a: Birmingham, Alabama, Greensboro, North Carolina i Athens, Georgia, gdje je održao predavanja.

Po povratku u Seattle dali su mu da predaje dodiplomski predmet *Linearna algebra*, a slušao je poslijediplomski predmet koji je predavao D. C. Ravenel, jedan od najboljih algebarskih topologa onog vremena. Gotovo svi ostali slušači su bili Kinezi i poneki Korejac i Japanac. I Mardešićevi demonstratori su bili Kinezi Cheng,

the lecture *Strong shape and strong homology* at the meetings of mathematicians of Graz and Zagreb.

In 1985/1986 professor Leonard Rubin from the University of Oklahoma in Norman, Oklahoma, USA, had ambitions to work with Mardešić, but due to his mother's illness, stayed in Zagreb as a Fulbright scholar until February 1987. Mardešić trips to Oklahoma and then to Seattle. The tireless Sibe Mardešić continues his scientific work now with his colleague L. Rubin on problems such as whether a CE mapping among metric compacta can raise the dimension. They soon published some positive results on that topic in *Pacific J. Math*. (48). After Oklahoma, where Vera Mardešić also held a lecture on *Convex functions* in the mathematics students'club, the Mardešić couple flew to Seattle again. As soon as they arrived in Seattle, professor Mardešić made a mini-tour to the southeast of the USA: Birmingham, Alabama, Greensboro, North Carolina and Athens, Georgia, where he held lectures.

Upon his return to Seattle, he was assigned to teach an undergraduate course in *Linear Algebra*, and he took a graduate course taught by D. C. Ravenel, one of the best algebraic topologists of the time. Almost all the other listeners were Chinese and a few Koreans and Japanese. And Mardešić's demonstrators were the Chinese Cheng, Chang and Chung. Segal and Mardešić continued to work and publish, and Rubin with them at a distance. Vera Mardešić also attended the *Geometry and Combinatorics Seminar* of professors Klee and Grünbaum that year and later published a paper in the prestigious journal *Geometriae Dedicata* (50).

As the Mardešićs studied Japanese intensively with Devidé and his wife Hondo for the past eight years, they wanted to check their knowledge on the spot, so they went on a one-month tour of Japan from Seattle, where Mardešić also held sever-

Chang i Chung. Segal i Mardešić nastavili su raditi i objavljivati, a s njima na daljinu i Rubin. I Vera Mardešić je te godine pohađala *Seminar za geometriju i kombinatoriku* profesora Kleeja i Grünbauma i kasnije objavila rad u uglednom časopisu *Geometriae Dedicata* (50).

Kako su posljednjih osam godina Mardešići uz Devidéa i njegovu suprugu Hondo intenzivno učili japanski, htjeli su na licu mjesta provjeriti svoja znanja pa su iz Seattlea otišli na jednomjesečnu turneju po Japanu, gdje je Mardešić održao i nekoliko predavanja. Nakon povratka u Seattle predavao je u jesenskom kvartalu 1987./1988. *Elementarne diferencijalne jednadžbe*, posjetio je Knoxville (Tennessee) i još neka mjesta prije dolaska u Zagreb, pred sam Božić.

Akademija, umirovljenje, profesor emeritus, nova knjiga

Ovdje će se opisati život i rad profesora Sibe Mardešića u razdoblju otprilike 1988. – 2000. U početku se bavio tzv. aproksimativnim rezolventama, a prve ideje je razradio još u Japanu s T. Watanabeom. To je rezultiralo s nekoliko članaka u *Glasniku mat*. (46) i drugdje. Osim zagrebačkih topologa koji su se bavili i teorijom oblika poput I. Ivanšića, Š. Ungara, Z. Čerin i drugih, uspio je Mardešić animirati i neke splitske kolege: V. Matijević, N. Uglešić, N. Koceić-Bilan i druge da rade u teoriji oblika. Glavnina aktivnosti ipak se odvijala na zagrebačkom topološkom seminaru. Tako je i nastalo ime *Zagreb school*, koje su inicirali stranci – gosti seminara.

al lectures. After returning to Seattle, he taught in the fall quarter of 1987/88 *Elementary differential equations*, he visited Knoxville (Tennessee) and some other places before arriving in Zagreb, right before Christmas.

Academy, retirement, professor emeritus, new book

Here, the life and work of professor Sibe Mardešić will be described in the period around 1988–2000. Now the topic in the focus was approximate resolvents, and he developed the first ideas back in Japan with T. Watanabe. This resulted in several papers in *Glasnik mat.* (46) and elsewhere. Apart from topologists from Zagreb who also dealt with shape theory, such as I. Ivanšić, Š. Ungar, Z. Čerin and others, Mardešić succeeded in animating some colleagues from Split: V. Matijević, N. Uglešić, N. Koceić-Bilan and others to work in the theory of shapes. Most of the activities, however, took place at the topology seminar in Zagreb. That is how the name *Zagreb school* was born, which was initiated by foreigners – guests of the seminar.

There were other mathematical areas of excellence, such as representation theory, analysis, geometry, discrete mathematics and graph theory, especially chemical, and others, later number theory and probability theory. According to Mardešić's words (1, p. 309): „I consider the introduction of approximate systems and resolvents among my best ideas". And about these ideas, he published a few papers alone or in co-authorship in *Glasnik mat*., *Topology Appl*., *Rad HAZU*, *Tsukuba J. Math*., e.g. (46, 49, 51, 52) and other journals. After that, he returns to work on strong homology. The Georgian Z. Miminoshvili works on axiomatic strong homology. With his exact sequences, they were

Bilo je i drugih matematičkih područja izvrsnosti, kao teorija reprezentacija, analiza, geometrija, diskretna matematika i teorija grafova, posebno kemijska, i druge, kasnije teorija brojeva i teorija vjerojatnosti. Prema Mardešićevim riječima (1, str. 309): „Uvođenje aproksimativnih sistema i rezolventi ubrajam među svoje najbolje ideje." I o tim je idejama objavio što samostalno, što zajednički nekoliko članaka u *Glasnik mat., Topology Appl., Rad HAZU, Tsukuba J. Math.,* npr. (46, 49, 51, 52) i drugi časopisi. Nakon toga vraća se radu na jakoj homologiji. Gruzijac Z. Miminošvili radi na aksiomatici jake homologije. S njegovim egzaktnim nizovima uspjeli su dokazati još neke tvrdnje (aksiom o grozdu i aksiom o relativnom homeomorfizmu). Nakon još nekoliko radova [(*Glasnik mat., Topology Appl*. i *Rad HAZU,* npr. (53)], u lipnju 1988. proglašen je Sibe Mardešić redovitim članom tadašnje Jugoslavenske akademije znanosti i umjetnosti (JAZU), od 1991. Hrvatska akademija znanosti i umjetnosti (HAZU). Od matematičara su u to vrijeme, ili nešto kasnije, redoviti članovi Akademije bili još S. Bilinski i V. Devidé, (koji je postao redoviti član 1990.) i Žarko Dadić (koji je postao redoviti član 1992.), dok su D. Blanuša i Z. Janković umrli 1987. Kasnije će redovitim članovima HAZU-a od matematičara postati M. Tadić, J. Pečarić, A. Dujella te G. Muić. Redovitih članova-matematičara HAZU je oduvijek imala najčešće četiri a najviše pet.

Nakon kraće konferencije u Sorrentu, Italija, u travnju 1989., te jednog manjeg sveučilišnog centra u Walesu, krajem

able to prove some other propositions (cluster axiom and relative homeomorphism axiom). After several more works [(*Glasnik mat*., *Topology Appl*. and *Rad HAZU*, e.g. (53)], in June 1988, Sibe Mardešić was declared a regular member of the Yugoslav Academy of Sciences and Arts (JAZU), since 1991 Croatian Academy of Sciences and Art (HAZU). Among mathematicians at that time, or a little later, regular members of the Academy were S. Bilinski and V. Devidé (who became a regular member in 1990) and Žarko Dadić (who became a regular member in 1992), while D. Blanuša and Z. Janković died in 1987. Mathematicians M. Tadić, J. Pečarić, A. Dujella and G. Muić will later become regular members of HAZU. HAZU has always regular members-mathematicians, usually four and at most five.

After a short conference in Sorrento, Italy, in April 1989, and a smaller university center in Wales, at the end of April, he visited the famous English University of Oxford, where he held a lecture on *Approximate inverse systems and cohomological dimensions.* Already in May, he went to Italy again on an invitation and held four lectures at a summer school in algebraic and geometric topology in Umbria. At the end of September, he went to Seville, Spain, where he also held several two-hour lectures on *Strong shape theory and homology*. The Spaniards were concerned with the theory of proper homotopy in which compact subsets ordered by inclusion are observed, so they considered that they could apply the techniques developed in the theory of shapes in their considerations. In October 1989, he was invited to a two-day meeting of geometers in Novi Sad, where he held a lecture on *Some new developments in the theory of dimensions*, and in November in Trieste, at the University and International Center for Theoretical Physics, where he gave two lectures on *Strong shape and strong homol-*

travnja posjećuje čuveno englesko Sveučilište Oxford gdje je održao predavanje *Approximate inverse systems and cohomological dimensions.* Već u svibnju odlazi opet na poziv u Italiju i drži četiri predavanja na ljetnoj školi iz algebarske i geometrijske topologije u Umbriji. Krajem rujna odlazi u Sevillu, Španjolska, gdje je održao više dvosatnih predavanja *Strong shape theory and homology*. Španjolci su se bavili teorijom prave homotopije u kojoj se promatraju kompaktni podskupovi uređeni inkluzijom pa su smatrali da tehnike razvijene u teoriji oblika mogu primijeniti u svojim razmatranjima. U listopadu 1989. pozvan je na dvodnevni skup geometričara u Novi Sad, gdje je održao predavanje *Neka nova dostignuća u teoriji dimenzija*, a u studenome u Trst, na Sveučilište i Međunarodni centar za teorijsku fiziku gdje je održao dva predavanja na temu *Strong shape and strong homology*. Potkraj iste 1989. S. Mardešić se počeo zanimati i za povijest znanosti, pa je u kraćem razdoblju napisao spomenicu preminulom akademiku Zlatku Jankoviću (54), te spomenicu u povodu 100. godišnjice rođenja Željka Markovića (55). Iste je godine Sveučilište u Zagrebu slavilo 320 godina postojanja, pa je S. Mardešić napisao članak o doprinosu matematike razvoju Zagrebačkoga sveučilišta (56). Iste je godine Sibe Mardešić postao i član Europske akademije, *Academia Europea*, sa sjedištem u Londonu (1), **slika 9**. Do godine 2000., Mardešić je bio jedini hrvatski matematičar član te Akademije, a na njegov je prijedlog tada izabran i akademik Marko Tadić.

ogy. At the end of 1989, S. Mardešić became interested in the history of science, so in a short period of time, he wrote a memorial to the deceased academician Zlatko Janković (54), and a memorial on the occasion of the 100th anniversary of the birth of Željko Marković (55). In the same year, the University of Zagreb celebrated its 320th anniversary, so S. Mardešić wrote an article about the contribution of mathematics to the development of the University of Zagreb (56). In the same year, Sibe Mardešić also became a member of the European Academy, *Academia Europea*, based in London (1) (**Figure 9**), Until 2000, Mardešić was the only Croatian mathematician member of that *Academy*, and academician Marko Tadić was also elected at his suggestion.

In May 1990, academician Mardešić again spent a month in Perugia, where he held 12 lectures, this time in Italian. Followed by a visit to Genoa, with a lecture at the then university. Already in June of the same year, the fifth Dubrovnik conference *Topology and its Applications* was held, where Mardešić held a lecture on *Homology and strong shape theory*. At the end of August 1990, he embarked on his third trip to Japan. He participated in the *General and Geometric Topology* symposium in Tsukuba. It was a three-week Japanese tour where he held five lectures in different places; one of them with the title *The relative homeomorphism and wedge axioms*, and the second two days later in Kobe *Approximate resolutions of spaces,* while the third was held in Osaka under the title *Strong homology theory*.

In 1990, Sibe Mardešić, at the proposal of the Mathematical Department of PMF, was awarded for excellent scientific work in the field of natural sciences, in the field of mathematics, especially topology: the *Republic Award for Lifetime Achievement* (1), **Figure 10**.

Although academician Sibe Mardešić retired on April 1, 1991 (a touching farewell lunch was pre-

U svibnju 1990. akademik Mardešić je opet na mjesec dana u Perugii, gdje je održao 12 predavanja ovaj put na talijanskome. Slijedi posjet Genovi, s predavanjem na ondašnjem sveučilištu. Već u lipnju iste godine održana je peta dubrovačka konferencija *Topology and its Applications*, gdje je Mardešić održao predavanje *Homology and strong shape theory*. Krajem kolovoza 1990. kreće na svoje treće putovanje u Japan. Sudjeluje na simpoziju *General and Geometric Topology* u Tsukubi. Bila je to trotjedna japanska turneja na kojoj je održao pet predavanja u različitim mjestima; jedno od njih s naslovom *The relative homeomorphism and wedge axioms*, a drugo dva dana kasnije u Kobeu *Approximate resolutions of*

pared at the Laguna Hotel on April 10), without taking advantage of the possibility of extending his work until the age of 70, that was not the end of his research or scientific activities. On the contrary!

Academician Sibe Mardešić was then accepted as the main researcher on the MZTIRH project with 12 researchers. At that time, the faculty was moved from Marulić Square 19 to Bijenička Cesta 30 in Zagreb.

On the third day after his retirement, professor Mardešić went to Genoa for the *Convegno Nazionale di Topologia*. In May 1991, he briefly stayed in Niš, Serbia, and held a lecture on *Approximate resolvents of topological spaces*, and in August 1991, at the *7th Prague Topological Symposium*, where Mardešić lectured on *Approximate inverse systems*.

SLIKA 9. **Povelja o primanju akademika Sibe Mardešića u Europsku akademiju (1)**
(prijevod s latinskoga Ana Mihaljević)

FIGURE 9. ***Charter on admission of academician Sibe Mardešić to the*** **Academiae Europaeae** ***(1)*** *(Translated from Latin by Ana Mihaljević)*

spaces, dok je treće održao u Osaki pod nazivom *Strong homology theory*.

Godine 1990. dobio je Sibe Mardešić, na prijedlog Matematičkog odjela PMF-a, još jedno priznanje za istaknuti znanstveni rad u oblasti prirodnih znanosti, u području matematike, napose topologije: *Republičku Nagradu za životno djelo* (1), **slika 10**.

Iako se 1. travnja 1991. akademik Sibe Mardešić umirovio (dirljiv oproštajni ručak pripremljen je u hotelu *Laguna* 10.

As the aggression of Serbia and the JNA against Croatia flared up at that time, numerous activities were suspended, for example, the Dubrovnik conference on geometric topology and shape theory (it was held only in 1998).

Despite everything, Mardešić continued to work, so in 1992/93 he wrote, alone or in co-authorship, four papers in reputable journals, e.g. (57). At the end of November 1991, he went on a two-week tour of Italy (Milan, Genoa, Perugia, L'Aquila and Trieste) and lectured everywhere, sometimes even twice, in Italian.

SLIKA 10. ***Republička Nagrada za životno djelo* akademiku Sibi Mardešiću (1)**
FIGURE 10. ***Republic Lifetime Achievement Award to academician Sibe Mardešić (1)***

travnja), ne iskoristivši mogućnost produljenja rada do 70. godine, to nije bio kraj njegovih istraživanja niti znanstvenih djelovanja. Naprotiv!

Akademik Sibe Mardešić tada je prihvaćen i za glavnog istraživača na projektu MZTIRH s 12 istraživača. U to je doba fakultet preseljen s Marulićevog trga 19 na Bijeničku cestu 30 u Zagrebu.

In March 1993, he was invited to hold a 20-hour mini-course on algebraic topology at the new doctoral studies in Milan. In June of the same year, the Mardešić couple went to Split to repair their apartment destroyed by aggressors during the Homeland War. On that occasion, he started a Topology Seminar at the at the PMF in Split, where he himself gave the first lectures.

Već treći dan nakon umirovljenja profesor Mardešić odlazi u Genovu na *Convegno Nazionale di Topologia*. U svibnju 1991. kratko je boravio u Nišu, Srbija, i tamo održao predavanje *Aproksimativne rezolvente topoloških prostora*, a u kolovozu 1991. na *7. Prague Topological Symposium* Mardešić je održao predavanje *Approximate inverse systems*. Kako se u to doba agresija Srbije i JNA na Hrvatsku razbuktala, brojne aktivnosti su suspendirane, npr. dubrovačka konferencija iz geometrijske topologije i teorije oblika (održana je tek 1998.).

Unatoč svemu, Mardešić je nastavio raditi, pa je 1992./1993. napisao, sam ili u suautorstvu, četiri rada u uglednim časopisima, npr. (57). Krajem studenoga 1991. krenuo je na dvotjednu turneju po Italiji (Milano, Genova, Perugia, L'Aquila i Trst) i svuda održao predavanje, ponegdje i dva, na talijanskome. U ožujku 1993. pozvan je da u Milanu na novom doktorskom studiju održi mini kolegij iz algebarske topologije od 20 sati. U lipnju iste godine bračni par Mardešić odlazi u Split popraviti stan koji je pogođen s agresorskog razarača u Domovinskom ratu. Tom je prilikom na PMF-u u Splitu pokrenuo *Seminar iz topologije*, na kojem je sam održao prva predavanja.

Drugi *Gauss Symposium,* 2. – 7. kolovoza 1993., održan je na Sveučilištu Ludwig-Maximillian u Münchenu. Karl Friedrich Gauss (1777. – 1855.) bio je jedan od najvećih matematičara u povijesti. Na skupu s oko 500 sudionika, profesor Sibe Mardešić je održao predavanje *Approximating spaces by polyhedra*, koje je

The second *Gauss Symposium*, August 2–7, 1993, was held at the Ludwig-Maximillian University in Munich. Karl Friedrich Gauss (1777–1855) was one of the greatest mathematicians in history. At a meeting with about 500 participants, professor Sibe Mardešić gave a lecture on *Approximating spaces by polyhedra*, which was published in the corresponding collection published by the publisher de Gruyter from Berlin (58).

A topological convention was held in Trieste on September 5–10, 1993, where S. Mardešić gave a lecture similar to the one in Munich. In November 1993, after two and a half years, the *Zagreb-Ljubljana* topological meeting was held again.

Scientifically, at that time, Sibe Mardešić worked intensively on an open problem: whether higher limes of homology pro-groups vanish for non-compact spaces. After months of work, he found counterexamples and published a paper about it in the world's leading journal *Topology*, which was published not until 1996. (59)

In the summer of 1994, in the old family house in Podšpilje, Mardešić constructed a paracompact space whose strong homology is nonzero, and every compact subset has a trivial strong homology. An article about it was rejected in *Trans. AMS*, but was accepted without objection in *Topology Appl.* (60).

In August of the same year, Mardešić went to the *World Mathematical Congress* in Zürich, where he presented a poster written with a felt-tip pen in large letters about his latest research.

At the end of March 1995, at the invitation of the organizers, he attended a conference for general topology in Spain, and then „on the way" he was invited to Madrid, then to Valencia.

All spring and summer Mardešić works on strong homology and spectral sequences, which three years later resulted in an important article in *Topology Appl.* on about 30 pages (co-authored

objavljeno u pripadnom zborniku u izdanju nakladnika de Gruyter iz Berlina (58).

U Trstu je 5. – 10. rujna 1993. održana topološka konvencija na kojoj je S. Mardešić održao predavanje slično kao u Münchenu. U studenome 1993. je nakon dvije i pol godine ponovno održan topološki sastanak *Zagreb-Ljubljana*. Znanstveno je u to vrijeme Sibe Mardešić intenzivno radio na otvorenom problemu: da li viši limesi homoloških pro-grupa iščezavaju za nekompaktne prostore. Protuprimjere je nakon mjeseci rada našao i rad o tome objavio u vrhunskome svjetskom časopisu *Topology,* koji je izašao tek 1996. (59).

U ljeto 1994., u staroj obiteljskoj kući u Podšpilju, Mardešić je konstruirao parakompaktni prostor čija je jaka homologija nenul, a svaki kompaktni podskup ima trivijalnu jaku homologiju. Članak o tome mu je odbijen u *Trans. AMS*, ali je bez primjedbe prihvaćen u *Topology Appl.* (60). U kolovozu iste godine otišao je na *Svjetski matematički kongres* u Zürichu, gdje je izložio poster pisan flomasterom krupnim slovima o svojim najnovijim istraživanjima.

Krajem ožujka 1995. na poziv organizatora boravio je na konferenciji za opću topologiju u Španjolskoj, a onda „usput" bio pozvan u Madrid, pa u Valenciju. Cijelo proljeće i ljeto radi na jakoj homologiji i proučava spektralne nizove, što je tri godine kasnije rezultiralo važnim člankom u *Topology Appl.* na 30-ak stranica (u suautorstvu s A. V. Prasolovim koji je deset godina ranije proveo studijsku godinu u Zagrebu): *Strong homology of compact spaces* (61). U studenome iste godine

with A. V. Prasolov, who ten years earlier spent a study year in Zagreb*)*: *Strong homology of compact spaces.* (61) In November of the same year, L. Rubin invited Mardešić to a joint meeting of the Mexican and American mathematical societies, but first he spent about 15 days in Oklahoma and held several lectures at the university there.

On May 14, 1996, academician Sibe Mardešić was elected to the title of *Professor Emeritus* of the University of Zagreb. This selection was initiated by the Mathematics Department of the Faculty of Sciences, submitting all documented activities, from numerous scientific papers in renowned international journals, professional papers, books in well-known publishing houses, numerous social activities, etc. At the end of May 1996, a celebration of the 100th anniversary of the birth of Kuratowski and the 90th anniversary of the birth of Borsuk was held at the Banach Institute in Warsaw, both very key figures for Mardešić. Therefore, he held a two-hour lecture on *Strong shape and homology* and met with old prominent friends – Segal, Rubin, Keesling, Toruńczyck, Maria Moszsyńska, Nowak, Spież, Ferry, Dranishnikov, Dydak and others.

At that time, the 120th anniversary of the first lecture in natural sciences and mathematics at the University of Zagreb was celebrated, and an occasion memorial was issued in which S. Mardešić wrote a chapter on the Department of Mathematics. He also wrote a short history of the development of mathematics in Croatia (62).

For the monograph *The History of Topology* published by North Holland, the editor I. M. James from Oxford invited Mardešić to write the article *The history of ANR theory and shape theory* (63). On July 1996, the *First Croatian Mathematical Congress* was held in Zagreb, which succeeded beyond all expectations. Almost all prominent Cro-

L. Rubin poziva Mardešića na zajednički sastanak meksičkoga i američkoga matematičkog društva, ali je prvo 15-ak dana proveo u Oklahomi i održao nekoliko predavanja na tamošnjem sveučilištu.

Dana 14. svibnja 1996. akademik Sibe Mardešić izabran je u zvanje *profesor emeritus* Sveučilišta u Zagrebu. Taj je izbor pokrenuo Matematički odjel PMF-a, prilažući sve dokumentirane aktivnosti, od brojnih znanstvenih radova u renomiranim svjetskim časopisima, stručnih radova, knjiga u poznatim izdavačkim kućama, brojnim društvenim aktivnostima itd. Krajem svibnja 1996. u Varšavi je na Banachovom institutu održana proslava 100. obljetnice rođenja Kuratowskog i 90. obljetnice rođenja Borsuka, obojica Mardešiću ključne osobe. Stoga je održao dvosatno predavanje *Strong shape and homology* i susreo se sa starim znancima – Segal, Rubin, Keesling, Toruńczyck, Maria Moszsyńska, Nowak, Spież, Ferry, Dranishnikov, Dydak i drugi.

U to je vrijeme proslavljena 120. obljetnica prvoga predavanja iz prirodoslovlja i matematike na Sveučilištu u Zagrebu, a izdana je i prigodna spomenica u kojoj je S. Mardešić napisao poglavlje o Matematičkom odsjeku. Napisao je i kratku povijest razvitka matematike u Hrvatskoj (62).

Za monografiju *The History of Topology* u izdanju North Hollanda, urednik I. M. James iz Oxforda pozvao je Mardešića da napiše članak *The history of ANR theory and shape theory* (63). U srpnju 1996. održan je u Zagrebu *Prvi hrvatski matematički kongres*, koji je uspio iznad svih očekivanja. Odazvali su se gotovo svi istaatian mathematicians responded, especially those from abroad. S. Mardešić held one of only four domestic invited lectures: *Strong shape and homology*. In October, he was invited to the *First Macedonian Mathematical Congress* in Ohrid, and in November 1996, by invitation, he held a colloquium at the HMD branch in Osijek on the topic of *30 years of shape theory*. As a lecturer, S. Mardešić always knew how to adapt to the audience and assess the level of knowledge of them, so he was gladly invited and listened to in all environments.

It is natural that scientists with more experience and years of doing science become interested in the history of their profession. Thus, on the occasion of the *50th anniversary of HMD* on November 4, 1995, Sibe Mardešić held a lecture under that title at the headquarters in Zagreb, and repeated it a few months later in Split in front of a large audience. He was glad to hear after the lecture when some approached him and said „he was their favorite professor". The author of this text agrees with that.

Springer Verlag, Japan, Warsaw, products and form, work as always

On June 20, 1997, the Mathematics Department of PMF and HMD celebrated the 70th anniversary of the academician Sibe Mardešić with a festive gathering. That spring and summer, Sibe and his wife Vera spent most of their time in Split and in Podšpilje near Komiža on island Vis. In Split, he also held 10 hours of lectures at a topological seminar, mainly on coherent homotopy, as well as a historical review of *30 years of shape theory*.

During the school year 1997/98 and the following, S. Mardešić taught the courses *Strong shape of topological spaces* and *Higher limes and strong homology* at the postgraduate studies in Zagreb. He

knuti hrvatski matematičari, posebno oni iz inozemstva. S. Mardešić je održao jedno od samo četiri domaća pozvana predavanja: *Strong shape and homology*. U listopadu je pozvan na *Prvi makedonski matematički kongres* u Ohridu, a u studenome 1996. po pozivu je održao kolokvij u podružnici HMD-a u Osijeku s temom *30 godina teorije oblika*. Kao predavač S. Mardešić se uvijek znao prilagoditi publici i procijeniti razinu znanja slušateljstva, pa je bio rado pozivan i slušan u svim sredinama.

Prirodno je da se znanstvenici s više iskustva i godina bavljenja znanošću počinju zanimati za povijest svoje struke. Tako je i Sibe Mardešić u povodu *50. obljetnice HMD-a* 4. studenog 1995. održao u središnjici u Zagrebu predavanje pod tim naslovom, i to ponovio nekoliko mjeseci kasnije u Splitu pred velikim slušateljstvom. Bilo mu je drago čuti nakon predavanja kad su mu neki prišli i kazali „da im je bio najdraži profesor". S time se slaže i autor ovoga teksta.

Springer Verlag, Japan, Varšava, produkti i oblik, radi kao i uvijek

Matematički odsjek PMF-a i HMD su 20. lipnja 1997. prigodnim svečanim skupom obilježili 70. godišnjicu akademika Sibe Mardešića. Toga su proljeća i ljeta Sibe i supruga Vera najviše vremena proveli u Splitu i u Podšpilju kod Komiže na Visu. U Splitu je održao i 10 sati predavanja na topološkom seminaru, uglavnom o koherentnoj homotopiji kao i povijesni pregled *30 godina teorije oblika*.

did all this preparing for the new book *Strong Shape and Homology* (64), and according to the principle „when you don't know anything well, give lectures". At the end of 1997, S. Mardešić was elected a member of the HAZU Presidency, and deputy secretary of the class for mathematical, physical and chemical sciences.

In the book *The History of Topology* edited by I. M. James, about 1,000 pages and published by Elsevier in 1999, as mentioned earlier, Mardešić's article *Absolute neighborhood retracts and shape theory* of about 30 pages was published (63). Two years later, in 2001, in another monograph published by Kluwer *Handbook of the History of General Topology*, S. Mardešić and J. Segal wrote a 30-page contribution *History of shape theory and its application to general topology*. (66)

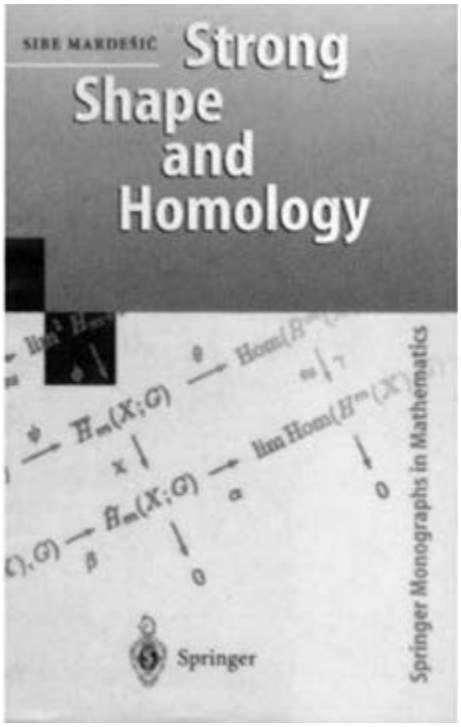
In May 1998, S. Mardešić finished his two-year work on the book *Strong Shape and Homology* (**Figure 11**) (1, p. 387). In the same month, he visited his son Pavo, a professor of mathematics at the University of Dijon, France, and in their topology seminar gave a French lecture on the theory of shapes and possible applications in the theory of dynamic systems, which Pavo Mardešić successfully deals with. More and more often, Sibe Mardešić also writes memories of deceased colleagues, and in 1999, the last professor who taught him as a student, Stanko Bilinski (1910–1999), died. He spent May–June 1998 in Perugia, and again in October 1999, and was invited to give a lecture on the history of science, *Topology in Eastern Europe*, 1900–1950, which was published in *Topology Proc. 2000* on 33 pages (67). Mardešić himself says (1, p. 378): „I gained a new perspective on the history of mathematics as a very interesting and important discipline. The historians of mathematics that I met there are interested in modern mathematics and have a good command of it, which is a prerequisite

Šk. god. 1997./1998. i sljedeće S. Mardešić je u Zagrebu na poslijediplomskom studiju držao predmete *Jaki oblik topoloških prostora* te *Viši limesi i jaka homologija*. Sve je to radio pripremajući se za novu knjigu *Strong Shape and Homology* (64), a prema načelu „kad nešto ne znaš najbolje, održi predavanja". Krajem 1997. S. Mardešić je izabran za člana Predsjedništva HAZU, te za zamjenika tajnika razreda za matematičke, fizičke i kemijske znanosti.

U knjizi *The History of Topology* urednika I. M. Jamesa od oko 1 000 stranica u izdanju Elseviera 1999., kako je ranije rečeno, izašao je i Mardešićev članak *Absolute neighborhood retracts and shape theory* od 30-ak stranica (63). Dvije godine kasnije, 2001. u drugoj monografiji u izdanju Kluwera *Handbook of the History of General Topology,* S. Mardešić i J. Segal napisali su prilog od 30-ak stranica *History of shape theory and its application to general topology*. (66)

U svibnju 1998. S. Mardešić je završio dvogodišnji rad na knjizi *Strong Shape and Homology* (**slika 11**) (1, str. 387). Istog je mjeseca posjetio sina Pavu, profesora matematike na Sveučilištu u Dijonu, Francuska, te u njihovom seminaru za topologiju održao na francuskome predavanje o teoriji oblika i moguće primjene u teoriji dinamičkih sistema, čime se Pavo Mardešić uspješno bavi. Sve češće Sibe Mardešić piše i sjećanja na preminule kolege, a 1999. umire i posljednji profesor koji mu je predavao kao studentu, Stanko Bilinski (1910. –1999.). Svibanj–lipanj 1998. provodi u Perugi, pa opet u listopadu 1999., a na poziv je održao predavanje iz povijefor being able to successfully describe the development of certain ideas".

After a smaller topological conference in Hungary at the beginning of August 1998, he spent



SLIKA 11. **Naslovna stranica knjige Sibe Mardešića *Strong Shape and Homology*, Springer Monographs in Mathematics, Springer, 2000. (1, str. 387)**

FIGURE 11. ***The front page of Sibe Mardešić's book* Strong Shape and Homology*, Springer Monographs in Mathematics, Springer, 2000 (1, p. 387)***

the second half of August in Berlin at the *World Mathematical Congress* with about 4,000 participants, where he gave a short presentation. He was most impressed by the lecture of A. Wiles, who three years earlier solved the famous Fermat prob-

sti znanosti *Topology in Eastern Europe, 1900–1950.*, koje je objavljeno u *Topology Proc. 2000*. na 33 stranice (67). Sam Mardešić kaže (1, str. 378): „Dobio sam nov pogled na povijest matematike kao vrlo zanimljivu i važnu disciplinu. Povjesničare matematike koje sam tu upoznao zanima suvremena matematika i njome dobro vladaju, što je preduvjet da mogu uspješno opisati razvoj pojedinih ideja".

Nakon manje topološke konferencije u Mađarskoj početkom kolovoza 1998., drugu polovicu kolovoza provodi u Berlinu na *Svjetskom matematičkom kongresu* s oko 4 000 sudionika, gdje je održao kratko priopćenje. Najviše ga se dojmilo predavanje A. Wilesa koji je tri godine ranije riješio čuveni Fermatov problem iz 1637. da ne postoje prirodni brojevi a, b, c i $n \geq 3$ tako da je $a^n + b^n = c^n$. U listopadu je u Dubrovniku na *Geometric topology* koju su organizirali profesori Ivan Ivanšić i Šime Ungar, a u studenome u Varšavi na sastanku na temu *Algebraic aspects of dimension theory* na koji je pozvan da održi predavanje o nadlaganjima (*overlays*). O tome je s profesoricom Vlastom Matijević iz Splita napisao već spomenuti članak u *Topology Appl.* na više od 40 stranica, tiskan 2001. (52). Početkom 2000. izašla mu je monografija *Strong Shape and Homology* (64). U (1) Sibe detaljno prenosi mišljenja recenzenata i pozitivnih opisa knjige u uglednim svjetskim časopisima, npr. opis knjige Tima Portera u *Bull. London Math. Soc.* iz 2001. (69)

Krajem lipnja 2002. ne može se oduprijeti pozivu Japanaca i odlazi na *Second Japan-Mexico Topology Symposium.* Na skupu blizu Osake bilo je više od 130 ljudi iz lem from 1637 that there are no natural numbers a, b, c and $n \geq 3$ such that $a^n + b^n = c^n$. In October, he was in Dubrovnik at *Geometric topology* organized by professors Ivan Ivanšić and Šime Ungar, and in November in Warsaw at a meeting on *Algebraic aspects of dimension theory*, where Mardešić was invited to hold a lecture on overlays. About this, together with professor Vlasta Matijević from Split, he wrote the aforementioned article in *Topology Appl.* on more than 40 pages, printed in 2001 (52). At the beginning of 2000, his monograph *Strong Shape and Homology* (64) was published. In (1) Sibe reports in detail the opinions of reviewers and positive descriptions of the book in reputable world journals, for example, Tim Porter's description of the book in *Bull. London Math. Soc*. from 2001. (69)

At the end of June 2002, he cannot resist the invitation of the Japanese and went to the *Second Japan–Mexico Topology Symposium*. At the gathering near Osaka, there were more than 130 people from 20 countries, and S. Mardešić held a lecture on *Products in shape theory. A resolution in the product of a compactum with a polyhedron*, about which the article (68) was published not until 2003. At the beginning of October 2002, the *Geometric Topology II* meeting was held in Dubrovnik with 62 participants from 15 countries. A month later, there was a topological workshop in Warsaw, where Mardešić spoke about the aforementioned joint work with professor Nikica Uglešić of Split *On iterated inverse limits* (51).

After the celebration of 30 years of the topological seminar *Zagreb–Ljubljana* in June 2003, Sibe Mardešić was elected a corresponding member of the Slovenian Academy of Sciences and Arts. In March 2004, the Ministry of Science, Education and Sports of the Republic of Croatia elected academician Sibe Mardešić as the presi-

20 zemalja, a S. Mardešić je održao predavanje *Products in shape theory. A resolution for the product of a compactum with a polyhedron* o čemu je članak (68) izašao tek 2003. Početkom listopada 2002. u Dubrovniku je sastanak *Geometric topology II*. sa 62 sudionika iz 15 zemalja. Mjesec dana kasnije u Varšavi je topološka radionica na kojoj je Mardešić govorio o već spomenutom zajedničkom radu s profesorom Nikicom Uglešićem iz Splita *On iterated inverse limits* (51).

Nakon proslave 30 godina rada topološkog seminara *Zagreb-Ljubljana* u lipnju 2003., Sibe Mardešić je izabran za dopisnoga člana Slovenske akademije znanosti in umetnosti. U ožujku 2004. Ministarstvo znanosti, obrazovanja i športa RH izabralo je akademika Sibu Mardešića za predsjednika Povjerenstva za izradu Hrvatskoga nacionalnog obrazovnog standarda za matematiku u osnovnoj školi (HNOS). Bio je to veliki posao mnogo (nas) matematičara, profesora i nastavnika koji je s prekidima trajao više od godinu dana.

U studenome 2003. na desetak je dana S. Mardešić opet u Madridu, gdje je održao dva predavanja, odsjeo je u poznatom Residencia de Estudiantes, pomno razgledavao muzej *Prado*, a nakon toga je također održao predavanja u nekoliko manjih sveučilišta blizu Madrida. U svibnju 2004., zajedno s prof. I. Ivanšićem pozvan je u Lavov u Ukrajini na topološku konferenciju i održao predavanje *On products in the shape categories*. Na dvije stranice sažeto i jasno obrazlaže povijest Ukrajine (1), posebice grada Lavova koji je bio malo u Galiciji (Austro-Ugarska Monarhija), malo u Poljskoj, dent of the *Committee for the Creation of the Croatian National Educational Standard for Mathematics in Elementary School* (HNOS). It was a big job for many (us) mathematicians, professors and teachers that lasted more than a year with interruptions.

In November 2003, S. Mardešić was again in Madrid for ten days, where he held two lectures, stayed in the famous Residencia de Estudiantes, carefully looked at the *Prado* museum, and after that, he also held lectures in several smaller universities near Madrid. In May 2004, together with prof. I. Ivanšić he was invited to Lviv in Ukraine for a topological conference and held a lecture *On products in the shape categories*. In two pages, he concisely and clearly explains the history of Ukraine (1), especially the city of Lviv, which was a little in Galicia (Austro-Hungarian Monarchy), a little in Poland, then in the USSR and finally in Ukraine. Hence the witty answer of the mathematician Stefan Banach (1892–1945) from Lviv, when asked if he ever crossed the border, he said: „no, but the border crossed over me several times". Prince Danilo founded Lviv in the 13th century and it was named after his son Lev, who in turn married the daughter of the Hungarian-Croatian King Bela IV, who took refuge from the Mongols in Zagreb and gave it the status of a royal city (Golden Bull from 1242). Another link with Ukraine is that the pharmacist Eugen Feller, the father of the famous Croatian mathematician Vilim Feller, was born in Lviv and emigrated from there to Zagreb, where he founded a company whose most famous product between the two world wars was „Elsa fluid" and the illuminated advertisement on Jelačić Square in Zagreb. About ten days in June 2004, Mardešić is in Perugia for the ninth time, where he teaches in Italian. Immediately after that, the

pa u SSSR-u i konačno u Ukrajini. Odatle i duhovit odgovor matematičara Stefana Banacha (1892. – 1945.) iz Lavova kad je upitan je li ikad prelazio granicu rekao: „ne, ali je granica više puta prelazila preko mene". Lavov je osnovao knez Danilo u 13. st. a ime je dobio po njegovu sinu Levu koji je pak oženio kćer ugarsko-hrvatskoga kralja Bele IV., koji se sklonio od Mongola u Zagrebu i dao mu status kraljevskoga grada (Zlatna bula iz 1242.). Druga je poveznica s Ukrajinom što je ljekarnik Eugen Feller, otac slavnoga hrvatskoga matematičara Vilima Fellera, rođen u Lavovu i odatle emigrirao u Zagreb, gdje je osnovao tvrtku koje je najpoznatiji proizvod između dva svjetska rata bio „Elsa fluid" i svijetleća reklama na Jelačićevu trgu u Zagrebu.

Desetak dana u lipnju 2004. Mardešić je već deveti put u Perugi, gdje predaje na talijanskome. Odmah nakon toga, *3. hrvatski matematički kongres* u Splitu uspio je iznad svih očekivanja (kongres je otvorio tadašnji predsjednik HMD-a, autor ovoga članka). U svom stanu u Splitu (Nazorova 4), Sibe i Vera ugostili su neke inozemne matematičare.

Sredinom 2004. Mardešić je postavio pitanje koje mu se prirodno nametnulo: je li Kartezijev produkt havajske naušnice i punktirane sume jediničnih kružnica produkt u kategoriji Sh(Top)? Dugo se bavio tim problemom, ali ga nije uspio riješiti do kraja života. I danas je to otvoreno pitanje.

Po pozivu profesora S. Illmana iz Finske u rujnu 2004. posjetio je Helsinki i tamo održao dva predavanja: *Shape theory* i *Topology in Eastern Europe 1900–1950.*

3rd Croatian Mathematics Congress in Split succeeded beyond all expectations (the congress was opened by the then president of HMD, the author of this article). In their apartment in Split (Nazorova 4), Sibe and Vera hosted some foreign mathematicians.

In the middle of 2004, Mardešić asked a question that naturally occurred to him: is the Cartesian product of the Hawaiian earring and the one-point union of the unit circles a product in the category Sh(Top)? He dealt with this problem for a long time but was unable to solve it until the end of his life. Even today it is an open problem.

At the invitation of professor S. Illman from Finland in September 2004, Mardešić visited Helsinki and held two lectures there: *Shape theory* and *Topology* in *Eastern Europe 1900–1950.* In the book (1), Mardešić wrote a short history of Finland and Helsinki, and interesting mathematical conversations with Illman, for example, can every real analytic manifold be analytically embedded in some Euclidean space? And that question is still open today.

In September-October 1999, Mardešić was again in Perugia and Umbria, and at the end of October in Madrid. At the end of May 2000, he was invited (for the umpteenth time) to Seattle on the occasion of the retirement of his most frequent co-author and friend professor Jack Segal (b. 1934), with whom he has 12 joint papers, one monograph and several edited conference proceedings. In June 2000, S. Mardešić participated in the *2nd Croatian Mathematical Congress*, and in August 2000 in Istanbul at the *First Turkish Intl. Conf. of Topology and its Appl*. Then for seven days in September 2000, he was in Ohrid again, and then in Perugia for three days. In those days, he was elected to the position of secretary of the Department for Mathematical, Physical and

U knjizi (1) je napisao kratku povijest Finske i Helsinkija, te zanimljive matematičke razgovore s Illmanom, npr. može li se svaka realna analitička mnogostrukost analitički smjestiti u neki euklidski prostor? I to je pitanje i danas otvoreno.

U rujnu–listopadu 1999. Mardešić je opet u Perugi i Umbriji, a krajem listopada u Madridu. Krajem svibnja 2000. pozvan je (po tko zna koji put) u Seattle u povodu umirovljenja svog najčešćeg suautora i prijatelja profesora Jacka Segala (r. 1934.) s kojim ima 12 zajedničkih članaka, jednu monografiju i nekoliko uređenih zbornika s konferencija. U lipnju 2000. S. Mardešić je sudionik *2. hrvatskoga matematičkog kongresa,* a u kolovozu 2000. u Istanbulu na *First Turkish Intl. Conf. of Topology and its Appl.* Zatim je sedam dana u rujnu 2000. opet u Ohridu, pa tri dana u Perugi. Tih je dana izabran na dužnost tajnika Razreda za matematičke, fizičke i kemijske znanosti HAZU, koju je obnašao tri godine. U studenome 2001. saznaje da je njegov suautor sedam radova i prijatelj Jurij Lisica obranio doktorat na MGU. Spomenimo ovdje da od 15-ak inozemnih matematičara koji su u Zagrebu proveli 1-2 semestra zbog rada s Mardešićem, s gotovo svakim od njih ima bar jedan zajednički rad.

U siječnju 2005. pozvan je Mardešić u Bari, Italija, u redakciju novog časopisa *Mediterranean J. Math*., a 3. – 10. srpnja 2005. u Poljskoj je održana velika konferencija *Geometric Topology* u povodu 100 godina rođenja K. Borsuka. Naravno, S. Mardešić je bio jedan od glavnih govornika, uz još šest hrvatskih matematičara.

Chemical Sciences at HAZU, which he held for three years. In November 2001, he found out that his co-author of seven papers and friend Jurij Lisica defended his doctorate at MGU. Let's mention here that about 15 foreign mathematicians spent 1-2 semesters in Zagreb due to work with Mardešić, he has at least one joint work with almost every one of them.

In January 2005, Mardešić was invited to Bari, Italy, to the editorial office of the new journal *Mediterranean J. Math*., and on July 3–10, 2005, a large *Geometric Topology* conference was held in Poland on the occasion of the 100th anniversary of the birth of K. Borsuk.

Of course, S. Mardešić was one of the main speakers, along with six other Croatian mathematicians. One of the main stars of the conference was the Croatian-American mathematician Mladen Bestvina, a professor at the University of Utah, an expert in the geometric theory of groups who gave four excellent lectures, as stated in (1) by Mardešić. In September, Mardešić was invited to the congress of the *Austrian Mathematical Society*, and in November, professor Jože Vrabec retired in Ljubljana with a joint *Zagreb-Ljubljana* seminar. And there, Mardešić presented a brief history of that seminar, which he was the main initiator of.

For most of 2006 until the end of February 2007, Mardešić worked on the geometry of certain simplex decompositions that belong to the theory of convex polytopes, which he needed for the construction of certain morphisms in the pro category H (pro-Top). He published an article about it in *Glasnik mat*. (70), and the second part in *Topology Appl.* and *Math. Commun.* (71). A total of 110 pages of text and almost 400 technically very complicated formulas. For an 80-year-old man – impressive.

Jedna od glavnih zvijezda konferencije bio je hrvatsko-američki matematičar Mladen Bestvina, profesor na University of Utah, stručnjak za geometrijsku teoriju grupa koji je održao četiri odlična predavanja, kako u (1) navodi Mardešić. U rujnu je Mardešić pozvan na kongres *Austrijskoga matematičkog društva*, a u studenome je u Ljubljani umirovljen profesor Jože Vrabec uz zajednički seminar *Zagreb-Ljubljana*. I tu je Mardešić izložio kratku povijest toga seminara čiji je bio glavni pokretač.

Veći dio 2006. do kraja veljače 2007. Mardešić je radio na geometriji određenih dekompozicija simpleksa što spada u teoriju konveksnih politopa što mu je trebalo za konstrukciju izvjesnih morfizama u prokategoriji H(pro-Top). Članak o tome objavio je u *Glasnik mat.* (70), a drugi dio u *Topology Appl.* i *Math. common* (71). Ukupno 110 stranica teksta i gotovo 400 tehnički vrlo zamršenih formula. Za čovjeka od 80 godina – impresivno.

U travnju su Sibe i supruga Vera dva dana proveli u Osijeku na skupu *Mathematics and children*, na kojem je bilo riječi o podizanju standarda metodike nastave matematike u osnovnim školama. U svibnju su Sibe i Vera sedam dana proveli u Madridu, gdje je Sibe održao dva predavanja, pa kaže (1, str. 439): „Mislim da su predavanja dobro uspjela, a tako ih je ocijenila i Vera, koja je inače strog kritičar i njezino mi je mišljenje uvijek važno".

Osamdeset mu je godina tek, AMS *Fellow*, *Prirodoslovlje*

Matematički odjel PMF-a je za 80. rođendan akademiku Sibi Mardešiću prire-

In April, Sibe and his wife Vera spent two days in Osijek at the *Mathematics and children* meeting, where they discussed raising the standards of mathematics teaching methods in elementary schools. In May, Sibe and Vera spent seven days in Madrid, where Sibe gave two lectures, so he says (1, p. 439): „I think the lectures went well, and so did Vera, who is normally a strict critic and her opinion is always important to me".

He is only eighty, AMS *Fellow*, *Prirodoslovlje*

For the 80th birthday of the academician Sibe Mardešić, the Mathematical Department of PMF organized a formal session attended by about 60 members of the Department and about 20 guests. Besides the rich snack one volume of *Glasnik matematički* (72), where Mardešić was the editor-in-chief for many years, is also dedicated to him. The volume has 256 pages and 16 papers, all with the subtitle *Dedicated to Professor Sibe Mardešić on the occasion of his 80th birthday*. He also received a number of electronic congratulations from numerous associates, colleagues and friends.

In September, the conference *Categories in geometry and mathematical physics* was held in Split, organized by the *Ruđer Bošković* Institute (IRB) at the MEDILS institute, where Mardešić gave a lecture on *Direct products in the shape categories*. The participants were distinguished mathematicians such as M. Kontsevich (winner of the Fields Medal), P. Cartier (a friend of Mardešić's from Princeton), both from Paris, and others. And already in October, *VI. Geometric Topology* was in Dubrovnik, a very strong conference with more than 70 participants from about 15 countries around the world. Sibe Mardešić gave one of the plenary lectures.

In June 2008, the *4th Croatian Mathematics Congress* was held in Osijek. Sibe gave a short

dio svečanu sjednicu na kojoj je bilo oko 60 članova Odjela i 20-tak gostiju. Osim bogate zakuske, posvećen mu je i svezak *Glasnika matematičkog* (72), kojega je svojedobno bio dugogodišnji glavni urednik. Svezak ima 256 stranica i 16 radova i svi su s podnaslovom *Dedicated to Professor Sibe Mardešić on the occasion of his 80th birthday*. Dobio je i niz elektroničkih čestitaka od brojnih suradnika, kolega i prijatelja.

U rujnu je u Splitu u organizaciji Instituta *Ruđer Bošković* (IRB) u institutu MEDILS održana konferencija *Categories in geometry and mathematical physics*, gdje je Mardešić održao predavanje *Direct products in the shape categories*. Sudionici su bili ugledni matematičari kao M. Kontsevich (dobitnik Fieldsove medalje), P. Cartier (Mardešićev prijatelj još iz Princetona) obojica iz Pariza i drugi. A već u listopadu bila je u Dubrovniku *VI. Geometric Topology*, vrlo jaka konferencija s više od 70 sudionika iz 15-ak zemalja diljem svijeta. Sibe Mardešić je imao jedno od plenarnih predavanja.

U lipnju 2008. je u Osijeku održan *4. hrvatski matematički kongres*. Sibe je održao kratko priopćenje o tome da ne postoji fantomsko preslikavanje čija je kodomena dimenzije 1. S njim je došla i supruga Vera „u njezin Osijek". Jedno je plenarno predavanje održao i Mladen Bestvina, profesor na University of Utah, Salt Lake City, Utah, SAD, rođen 1959. u Osijeku, a diplomirao je 1982. u Zagrebu kod prof. Mardešića. U rujnu je S. Mardešić pozvan u Ohrid na proslavu 85. godišnjice profesora Blagoja Popova.

speech about the fact that there is no phantom mapping whose codomain is dimension 1. His wife Vera came with him „to her Osijek". One plenary lecture was also held by Mladen Bestvina, professor at the University of Utah, Salt Lake City, Utah, USA, born in 1959 in Osijek, and graduated in 1982 in Zagreb with prof. Mardešić. In September, S. Mardešić was invited to Ohrid to celebrate the 85th anniversary of the professor Blagoje Popov.

Although meticulous, Sibe Mardešić made mistakes (very rarely); namely, he only recently discovered that the proofs of two lemmas from his paper from 1958 are not entirely correct. However, in the summer of 2009, he managed to correct the proofs of the lemma so that the main theorem was saved. In *Glasnik mat*. in 2010, he published a five-page correction (73).

On the occasion of the 100th anniversary of the birth of academician Stanko Bilinski, otherwise Mardešić's professor from way back in 1949/50, HAZU erected a bust of him in his native Našice in 2010. In 2009–2010, Mardešić's colleagues and friends, professors Dominik Palman (1924–2008)[4], Zdravko Kurnik (1937–2010), Vladimir Devidé (1925–2010), Krešo Horvatić and Svetozar Kurepa (1929–2010), passed away. Kurepa, together with Mardešić, was the main organizer of the postgraduate study of mathematics in Zagreb in 1960. On the occasion of the 50th anniversary of that study, at the Department's ceremonial session on June 8, 2011, Mardešić gave a brief overview of the history of mathematics studies at the University of Zagreb, from the first professors Karel Zahradnik in 1876, to Vladimir Varićak from 1899, Chair of Geometry Juraj Majcen and Ru-

[4] D. Veljan i V. Volenec: *Profesor geometrije Dominik Palman (1924. – 2008.),* Prirodoslovlje **18**(1-2) (2018) 87–104.

Iako pedantan, Sibe Mardešić je (vrlo rijetko) i pogriješio; naime tek je nedavno otkrio da dokazi dviju lema iz njegova rada iz 1958. nisu posve korektni. No, u ljeto 2009. uspio je korigirati dokaze lema tako da je glavni teorem spašen. U *Glasniku mat.* 2010. objavio je korekciju na pet stranica (73).

U povodu 100. godišnjice rođenja akademika Stanka Bilinskoga, inače Mardešićeva profesora iz davne 1949./1950., HAZU mu je 2010. u rodnim Našicama podigla poprsje. U godinu i nešto dana 2009. – 2010. preminuli su Mardešićevi kolege i prijatelji, profesori Dominik Palman (1924. – 2008.)[4], Zdravko Kurnik (1937. – 2010.), Vladimir Devidé (1925. – 2010.), Krešo Horvatić i Svetozar Kurepa (1929. – 2010.). Kurepa je s Mardešićem još 1960. bio glavni organizator poslijediplomskoga studija matematike u Zagrebu. U povodu 50. obljetnice toga studija, na svečanoj sjednici Odjela 8. lipnja 2011., Mardešić je u kraćem osvrtu ukratko ispričao povijest studija matematike na zagrebačkom sveučilištu, od prvih profesora Karela Zahradnika 1876., pa Vladimira Varićaka od 1899., katedre za geometriju Jurja Majcena te Rudolfa Cesarca, katedre za teorijsku fiziku i primijenjenu matematiku 1939., preko osnivanja PMF-a 1946./1947., prvih čelnika zavoda Đure Kurepe, Stanka Bilinskoga i Željka Markovića sve do osnivanja spomenutog studija i usporedbe s današnjim

[4] D. Veljan i V. Volenec: *Profesor geometrije Dominik Palman (1924. – 2008.),* Prirodoslovlje **18**(1-2) (2018) 87–104.

dolf Cesarec, chair of theoretical physics and applied mathematics in 1939, through the establishment of PMF in 1946/47, the first heads of the institute Đuro Kurepa, Stanko Bilinski and Željko Marković until the establishment of the mentioned study and comparison with today's contemporary doctoral study, about which he wrote extensively in (1).

Sibe Mardešić continues to work scientifically and professionally, and between 2010 and 2012 he publishes several papers, for example in *Top. Appl.*, *Rad HAZU* (74-76). In (74, 75) he considers the so-called phantom mappings among CW complexes that have the property that restrictions on finite subcomplexes are nullhomotopic.

Here is the connection between Academician Mardešić and the Division of Natural Sciences and Mathematics of Matica Hrvatska. Academician Mardešić accidentally met Dr. Marko Tarle, the former head of the Division and suggested that on June 1, 2012, as a resident of Komiža and an academician, he give a lecture about the rich history of the island of Vis at the *Waters and Seas of the Island of Vis* meeting on June 1, 2012 under the title *The stormy history of the island of Vis.*

In October 2012, at the meeting *Croatian naturalists 21* (Hrvatski prirodoslovci 21) in Imotski, professor S. Mardešić spoke and wrote an article for *Prirodoslovlje* about the teacher of descriptive geometry Juraj Božičević (77, 78), who also taught his father at the Split high school. At the next meeting in October 2013 in Križevci, prof. Mardešić and the author of this article wrote together at the *Croatian naturalists 22* (Hrvatski prirodoslovci 22) an article about professor Vladimir Vranić (1896–1976), a pioneer of electronic computing in Croatia (11). Namely, professor Vranić at the time of the purchase of the first computer (which occupied two rooms) in

suvremenim doktorskim studijem, o čemu je opširno pisao u (1).

Sibe Mardešić nastavlja znanstveno i stručno djelovati pa 2010. – 2012. objavljuje više radova, primjerice u *Top. Appl., Rad HAZU* (74-76). U (74, 75) razmatra tzv. fantomska preslikavanja među CW kompleksima koje imaju svojstvo da su restrikcije na konačnim podkompleksima nulhomotopne.

Evo i veze akademika Mardešića s Odjelom za prirodoslovlje i matematiku Matice hrvatske. Akademik Mardešić je slučajno upoznao dr. Marka Tarlea, nekadašnjeg pročelnika Odjela, koji mu je predložio da na skupu „Vode i more otoka Visa" 1. lipnja 2012. kao Komižanin i akademik uvodno kaže ponešto o bogatoj povijesti otoka Visa, pa je održao predavanje pod naslovom „Burna povijest otoka Visa".

U listopadu 2012. na skupu *Hrvatski prirodoslovci 21* u Imotskome, profesor S. Mardešić je govorio i napisao članak za *Prirodoslovlje* o profesoru nacrtne geometrije Jurju Božičeviću (77, 78), koji je predavao i njegovu ocu u splitskoj gimnaziji. Na sljedećem skupu u listopadu 2013. u Križevcima, prof. Mardešić i autor ovoga članka zajedno su na skupu *Hrvatski prirodoslovci 22* s člankom o profesoru Vladimiru Vraniću (1896. – 1976.), piониru elektroničkog računarstva u Hrvatskoj (11). Naime, prof. Vranić je u doba nabavke prvog računala (koje je zauzimalo dvije sobe) 1967. iz Francuske za IRB, bio ravnatelj tadašnjeg Instituta za matematiku preko kojeg je računalo kupljeno. Zato je u članku nazvan „pionir".

1967 from France for the IRB, was the director of the then Institute of Mathematics through which the computer was purchased. That is why he was called a „pioneer" in the article.

In January 2013, the American Mathematical Society (AMS), the strongest of its kind in the world, included Sibe Mardešić as *Fellow*, one can say honorary member (1), **Figure 12**. On that list of 1,119 prominent mathematicians in the world (out of about 35,000 AMS members), Mardešić is the only one from Croatia, along with three other Croatian mathematicians who live and work in America (M. Bestvina, B. Grünbaum and D. Miličić, and from 2020 Sunčica Čanić). This is a great honor given to him by the profession for outstanding contributions to the creation, clarification, progress and application of mathematics. He was very proud of it. Rightly so!

Mardešić continues to work tirelessly. In 2014 and 2015, he published three more articles, two in *Topology Appl.* (26), and one in *Rad HAZU, Mat. Zn.* (78) In June 2015, the *Dubrovnik VIII* conference was organized, a series that Sibe Mardešić started back in 1976. This time the focus of the conference was no longer on the shape theory, but on the geometric theory of groups, geometric topology and dynamical systems.

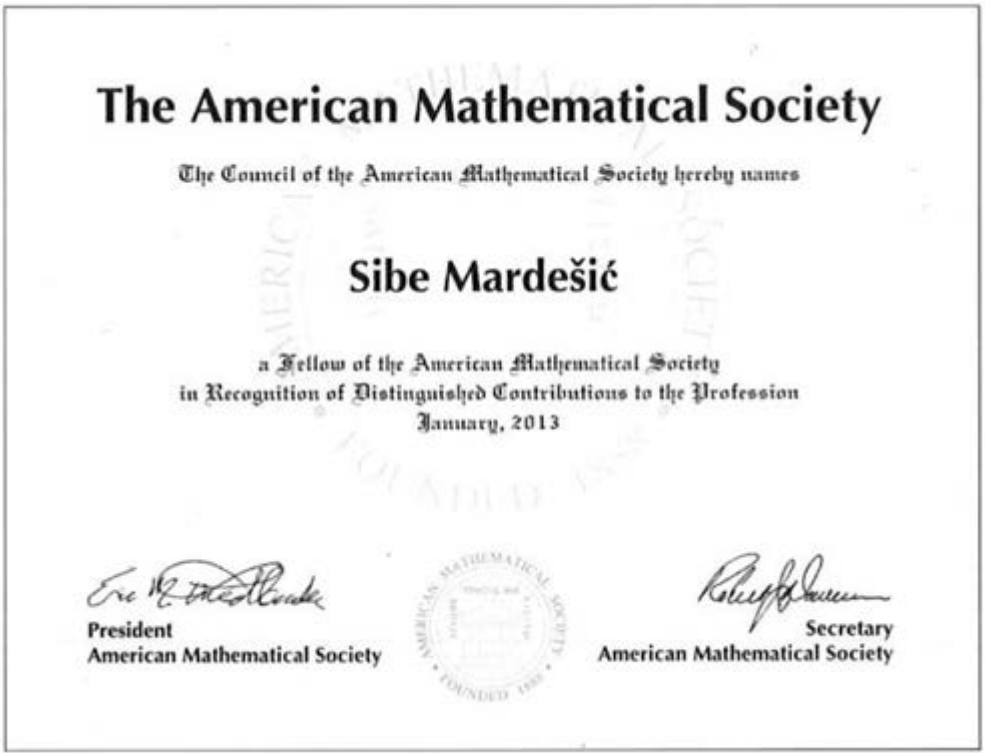
In June 2016, the *6th Congress of Croatian Mathematicians* was held in Zagreb, to which academician Sibe Mardešić also registered with a lecture scheduled for June 17. Unfortunately, he fell ill two days earlier, he was immediately transferred to the KBC Zagreb hospital, where he died of heart failure on June 18, 2016, two days before his 89th birthday.

Here are the last sentences of that giant of science, mathematics, especially topology and the even more special theory of (strong) shape and homology, a lover of science, thinker and professor, who tried to understand history, art, and glob-

Američko matematičko društvo (AMS), najjače takve vrste u svijetu je u siječnju 2013. Sibu Mardešića uvrstilo u *Fellows*, može se reći počasne članove (1), **slika 12**. Na tom popisu od 1 119 istaknutih matematičara u svijetu (od oko 35 000 članova AMS-a), jedino je Mardešić iz Hrvatske, uz još tri hrvatska matematičara koji žive i rade u Americi (M. Bestvina, B. Grünbaum i D. Miličić, a od 2020. i Sunčica Čanić). To je velika čast koju mu je iskazala struka za istaknute doprinose u stvaranju, pojašnjavanju, napretku i primjeni matematike. Bio je vrlo ponosan na to. S pravom!

al politics, but until his last breath still science, and the last sentences of his impressive book (**Figure 13**), read (1):

„My wish was to solve the problem of the product of the Hawaiian earring and the one-point union of the 1-spheres sequence before completing this book and to include the result in the book. Unfortunately, despite all efforts, this did not happen. At some moments it seemed to me that I was close to a solution, and I even spoke about it at the seminars in Split (May 5 and 6, 2016) and Ljubljana (May 14, 2016), but no solution was reached. This is often the case in mathematics. One link in the reasoning chain gives way and everything collapses."


The American Mathematical Society

The Council of the American Mathematical Society hereby names

Sibe Mardešić

a Fellow of the American Mathematical Society
in Recognition of Distinguished Contributions to the Profession
January, 2013

President
American Mathematical Society

Secretary
American Mathematical Society

SLIKA 12. **Akademik Sibe Mardešić, *Fellow* Američkoga matematičkog društva (1)**
FIGURE 12. ***Academician Sibe Mardešić*, Fellow *of the American Mathematical Society (1)***

Mardešić i dalje neumorno radi. Godine 2014. i 2015. izašla su mu još tri članka, dva u *Topology Appl.* (26), i jedan u *Rad HAZU, Mat. zn.* (78). U lipnju 2015. organizirana je konferencija *Dubrovnik VIII*., serija koju je Sibe Mardešić započeo još 1976. Ovoga puta težište konferencije više nije bilo na teoriji oblika nego na geometrijskoj teoriji grupa, geometrijskoj topologiji i dinamičkim sustavima.

U lipnju 2016. u Zagrebu se održavao *6. kongres hrvatskih matematičara* na koji se prijavio i akademik Sibe Mardešić s predavanjem koje je bilo predviđeno za 17. lipnja. Nažalost, dva dana ranije pozlilo mu je, odmah je prebačen u bolnicu KBC Zagreb, gdje je preminuo od zatajenja rada srca 18. lipnja 2016., dva dana prije njegova 89. rođendana.

Evo posljednjih rečenica toga velikana znanosti, matematike, posebice topologije i još posebnije teorije (jakog) oblika i homologije, zaljubljenika u znanost, promišljanja i profesuru, koji je pokušavao razumjeti povijest, umjetnost i globalnu politiku, ali do posljednjega daha ipak znanost, a zadnje rečenice njegove impresivne knjige, **slika 13**, glase (1):

„Želja mi je bila da prije dovršetka ove knjige riješim problem produkta havajske naušnice i punktirane sume niza 1-sfera te da rezultat uključim u knjigu. Nažalost, usprkos svim nastojanjima to se nije dogodilo. U nekim mi se trenutcima činilo da sam blizu rješenja, pa sam čak o tome i govorio na seminarima u Splitu (5. i 6. svibnja 2016.) i Ljubljani (14. svibnja 2016.), ali do rješenja ipak nije došlo. Tako je to često u matematici.

He was pleased to hear from people involved in Scientology (the science of science), for example academician Vladimir Paar, that his [Sibe's] articles have been read and cited (up to 2016)

SLIKA 13. **Naslovnica knjige Sibe Mardešića, *Kako sam postao i ostao matematičar*** (1)

FIGURE 13. ***Cover of Sibe Mardešić's book,*** **How I became and remained a mathematician *(1)***

about 2,040 times (of which about 450 times book with Segal), which is a lot for mathematics; if it is to be compared with citations in physics, these figures should be multiplied by four, and for medicine the factor is at least eight. Data from Google Scholars (including the year 2022) say that the total citation of Sibe Mardešić is about 3,900 times.

Jedna karika u lancu zaključivanja popusti i sve se ruši."

Bilo mu je drago čuti od ljudi koji se bave *scientologijom* (znanost o znanosti), npr. akademika Vladimira Paara, da su njegovi [Sibini] članci čitani i citirani (do 2016.) oko 2 040 puta (od toga oko 450 puta knjiga sa Segalom), što je za matematiku puno; ako se to želi usporediti s citiranošću u fizici, te brojke treba pomnožiti s četiri, a za medicinu je faktor barem osam. Podatci iz Google Scholarsa (uključivši 2022. godinu) kažu da je ukupna citiranost Sibe Mardešića oko 3 900 puta.

Nadalje, kažu scijentolozi, akademik Sibe Mardešić održao je u karijeri 333 predavanja u 117 gradova u 22 zemlje (1, 2, 79). Pod njegovim je vodstvom izrađeno 9 doktorskih disertacija, 32 magistarska rada i više od 100 diplomskih radova.

Profesor Sibe Mardešić slovio je za izvrsnoga predavača (80), **slika 14**, generacije studenata hvalile su njegova predavanja, uz dobru koncepciju i dokaze teorema do zadnjega zareza, jasnu dikciju te lijep rukopis po ploči. Isto je tražio i od predavača na seminarima, studenata. To je iskusio i autor ovoga članka, na čemu je zahvalan profesoru Mardešiću.

Koliko je Sibe Mardešić volio svoj posao ocrtava i sljedeća anegdota. Topološki su se seminari tradicijski održavali ponedjeljkom od 10 do 12 sati na Elektrotehničkom fakultetu u Zagrebu(današnji Fakultet elektrotehnike i računarstva, FER), pa bi se nakon seminara nas nekoliko laganom 10-minutnom šetnjom vraćali na PMF, čavrljajući o svemu i svačemu. Jed-

Furthermore, Scientologists say, academician Sibe Mardešić held 333 lectures in 117 cities in 22 countries during his career (1, 2, 79). Under his guidance, 9 doctoral dissertations, 32 master's theses and more than 100 undergraduate thesis were prepared.

SLIKA 14. **Profesor Sibe Mardešić kao predavač (80)**

FIGURE 14. ***Professor Sibe Mardešić as a lecturer (80)***

Professor Sibe Mardešić was known as an excellent lecturer (80), **Figure 14**, generations of students praised his lectures, with a good concept and proofs of theorems down to the last comma, clear diction and beautiful handwriting on the blackboard. He asked the same from lecturers at seminars and students. The author of this article also experienced this, for which he is grateful to professor Mardešić.

How much Sibe Mardešić loved his job is illustrated by the following anecdote. Topological seminars were traditionally held on Mondays from 10 a.m. to 12 noon at the Faculty of Electrical Engineering in Zagreb (today's Faculty of Electrical Engineering and Computing, FER), so after the sem-

nom je prilikom Sibe rekao, šaleći se, da bismo zapravo mi trebali plaćati državi, a ne obrnuto, što nam omogućuje da se bavimo ovim poslom kojeg tako volimo.

Kako i sam Sibe Mardešić u svojoj autobiografiji (1) navodi, imao je „dug, sretan, ispunjen i lijep život". U znak sjećanja posvećeni su mu članci u *Rad HAZU* (2), u *Glasnik mat.* (79) i čitav broj *Rad HAZU* (81). Također, posebni (virtualni) broj časopisa *Topology and its Applications* iz 2019., uredili su M. Bestvina, S. Dranishnikov, S. Ferry i Š. Ungar, ima 17 članaka uključujući i Mardešićev članak (82).

Zaključak

Popis svih radova akademika Sibe Mardešića u (79) može se sažeti ovako: 160 strogo znanstvenih radova, 51 stručni rad te 20 knjiga i skripata. Zaista zadivljujuće! Sve to ukazuje da je Sibe Mardešić bio ne samo izuzetno sposoban i oštrouman znanstvenik i znalac, nego i vrlo marljiv i radišan znanstveni pisac. Volio je i živu riječ, pa je osim brojnih predavanja i seminara na matičnom fakultetu u Zagrebu (i u Splitu i po Hrvatskoj) održao i oko 340 predavanja i seminara diljem svijeta. Imao je golemo znanje klasične matematike, dobar uvid u suvremenu matematiku i dubinsko poznavanje gotovo svih dijelova suvremene topologije. Bio je recenzent i ocjenjivač nebrojeno mnogo znanstvenih i stručnih radova te knjiga i član povjerenstava za napredovanje mnogih znanstvenika. Učio je i znanstveno razmišljao i predavao doslovce do posljednjeg dana života. Govorio je tečno i čitao engleski,

inar a few of us would take a leisurely 10-minute walk back to PMF, chatting about anything and everything. On one occasion Sibe said, jokingly, that we should actually be paying the state, not the other way around, which allows us to do this work that we love so much.

As Sibe Mardešić states in his autobiography (1), he had a „long, happy, fulfilling and beautiful life". As a sign of his memory, articles were dedicated to him in *Rad HAZ* (2), in *Glasnik mat*. (79) and the entire number of *Rad HAZU* (81). Also, the special (virtual) issue of the journal *Topology and its Applications* from 2019, edited by M. Bestvina, S. Dranishnikov, S. Ferry and Š. Ungar, has 17 articles, including Mardešić's article (82).

Conclusion

The list of all academician Siba Mardešić's works in (79) can be summarized as follows: 160 strictly scientific works, 51 expert works and 20 books and scripts. Really stunning! All this indicates that Sibe Mardešić was not only an extremely capable and shrewd scientist and connoisseur, but also a very diligent scientific writer. He also loved the living word, so in addition to numerous lectures and seminars at his home university in Zagreb (and in Split and throughout Croatia), he also held around 340 lectures and seminars around the world. He had a vast knowledge of classical mathematics, a good insight into modern mathematics and in-depth knowledge of almost all parts of modern topology. He was a reviewer and evaluator of countless scientific and professional works and books and a member of commission for the advancement of many scientists. He studied and thought scientifically and taught literally until the last day of his life. He spoke fluently and read English, German,

njemački, francuski, talijanski, ruski, a donekle španjolski i japanski. Kao osoba, Sibe Mardešić bio je vrlo drag, susretljiv, nenametljiv i dobroćudan.

French, Italian and Russian, and to some extent Spanish and Japanese. As a person, Sibe Mardešić was very nice, accommodating, unobtrusive and good-natured.

LITERATURA/ *REFERENCES*

1. S. Mardešić: *Kako sam postao i ostao matematičar, Matematička autobiografija,* Školske novine, Zagreb, 2016., 483 str.
2. A. Dujella, M. Tadić, I. Ivanšić i Š. Ungar: *Sibe Mardešić*, In memoriam (M. Tadić, ur.), HAZU, Zagreb, 2017.
3. D. Veljan: *More on Croatian and Zagreb Mathematics*, Mathematical Intelligencer **72** (2020) 49–54.
4. Ž. Dadić: *Povijest znanosti i prirodne filozofije u Hrvata (s obzirom na egzaktne znanosti),* Knjiga VIII., *Suvremeno doba* (1941. – 1970.), Izvori, Zagreb, 2020.
5. D. Veljan: *Profesor Đuro Kurepa (Majske Poljane, 1907. – Beograd, 1993.),* Prirodoslovlje **7** (2007) 63–85.
6. *Vladimir Varićak* (S. Paušek-Baždar i K. Ilakovac, ur.), HAZU, Zagreb, 2018., 300 str.
7. D. Veljan i I. Vuković: *Rudolf Cesarec (1889. – 1972.), matematičar i ratni prorektor zagrebačkog Sveučilišta*, Prirodoslovlje **20**(1-2) (2020) 79–100.
8. B. Pavković i V. Volenec: *In memoriam, akademik Stanko Bilinski (22. 4. 1909. – 6. 4. 1998.)*, Glasnik matematički **33** (1998) 323–333.
9. S. Mardešić: *Sjećanje na profesora Stanka Bilinskog*, *Spomenica preminulim akademicima,* HAZU **88** (1999) 40–42.
10. D. Veljan: *Akademik Zlatko Janković, matematički fizičar*, Prirodoslovlje **8** (2008) 65–78.
11. S. Mardešić i D. Veljan: *Profesor Vladimir Vranić (1986. – 1976.), matematičar i pionir elektroničkog računarstva u Hrvatskoj*, Prirodoslovlje **13** (2013) 227–239.
12. D. Veljan: *Akademik Željko Marković, profesor matematike*, Prirodoslovlje **9** (2009) 183–200.
13. D. Veljan: *Profesor Pavle Papić, istaknuti matematičar, Antofagasta, Čile, 1919. – Zagreb, 2005*., Prirodoslovlje **12** (2012) 191–204.
14. S. Mardešić: *Über die Unabhängigkeit (mod G) der ganzzahligen Linearformen,* Glasnik Mat.-Fiz. Astron. **8** (1953) 280–292.
15. H. Seifert und W. Threlfall: *Lehrbuch der Topologie,* Teubner, Leipzig, 1934.
16. S. Mardešić et P. Papić: *Sur les espaces dont toute transformation réelle continue est bornée*, Glasnik Mat.-Fiz. Astron. **10** (1955) 225–232.
17. K. Borsuk: *Concerning the homological structure of the functional space* S_m^X, Fund. Math. **39** (1952) 25–37.

18. S. Mardešić: *On the homology of function spaces,* Glasnik Mat.-Fiz. Astron. **11** (1956) 169–254.
19. S. Mardešić: *Comparison of singular and Čech homology for ANR's. Application to unicoherence*, Fund. Math. **46** (1958) 29–45.
20. D. Žubrinić: *Vilim Feller – istaknuti hrvatsko-američki matematičar / William Feller – Distinguished Croatian-American Mathematician*, Graphis, Zagreb, 2011.
21. S. Mardešić: *On the Hahn-Mazurkiewicz theorem in nonmetric spaces*, Proc. Amer. Math. Soc. **11** (1960) 929–937.
22. S. Mardešić: *On covering dimension and inverse limits of compact spaces,* Illinois J. Math. **4** (1960) 278–291.
23. S. Mardešić and J. Segal: *ε-mappings onto polyhedra*, Trans. Amer. Math. Soc. **109** (1963) 146–164.
24. S. Mardešić and J. Segal: *ε-mappings and generalized manifolds*, Michigan Math. J. **14** (1967) 171–182.
25. K. Borsuk: *Concerning the notion of the shape of compacta,* Proc. Intern. Symp. on Topology and its Applications (Herceg Novi, 1968), Belgrade, 1969., pp. 98–104.
26. S. Mardešić: *Continuous images of linearly ordered continua and compacta*, Topology Appl. **195** (2015) 34–49.
27. S. Mardešić and J. Segal: *Shapes of compacta and ANR systems,* Fund. Math. **72** (1971) 41–59.
28. S. Mardešić: *Shapes for topological spaces,* Gen. Topology Appl. **3** (1973) 265–282.
29. S. Mardešić: *Equivalence of two notions of shape for metric spaces*, Bull. Acad. Polon. Sci. Sér. Sci. Math. Astron. Phys. **21** (1973) 1131–1136.
30. S. Mardešić: *Pairs of compacta and trivial shape*, Trans. Amer. Math. Soc. **189** (1974) 329–336.
31. S.Mardešić: *Compact subsets of R^n and dimensions of their projections,* Proc. Amer. Math. Soc. **41** (1973) 631–633.
32. S. Mardešić: *Matematička analiza u n-dimenzionalnom realnom prostoru,* I. dio*,* Školska knjiga, Zagreb, 1974., vii+272, II. izd. 1979., III. izd. 1988., IV. izd. 1991.
33. S. Mardešić: *Matematička analiza u n-dimenzionalnom realnom prostoru*, II. dio, Školska knjiga, Zagreb, 1977., viii+275, II. izd. 1984., III. izd. 1989.
34. Ž. Hanjš, D. Veljan i I. Vuković: *Boris Pavković – profesor, matematičar i metodičar (Zagreb, 1931. – Zagreb, 2006.)*, Prirodoslovlje **21**(1-2) (2021) 59–76.
35. S. Mardešić: *Sjećanje na profesora Krešu Horvatića (1930. – 2008.*), Glasnik Mat. **43** (2008) 551–553.
36. Š. Ungar: *In memoriam prof. dr. sc. Ivan Ivanšić (Gradište, 9. 7. 1931. – Zagreb, 7. 6. 2020.),* Glasnik Mat. **56** (2021) 559–568.
37. S. Mardešić and B. Rushing; *Shape fibrations II*, Rocky Mountain J. Math. **9** (1979) 283–298.

38. S. Mardešić: *Shape theory, in*: Proc. Int. Congress of Math., Helsinki, 1978, Vol. 1, 481–489.
39. J. Keesling and S. Mardešić: *A shape fibration with fibers of different shape*, Pacific J. Math. **84** (1979) 319–331.
40. S. Mardešić: *Approximate polyhedra, resolutions of maps and shape fibrations,* Fund. Math. **114** (1981) 53–78.
41. S. Mardešić and J. Segal: *Shape Theory*, North Holland Publ. Comp, Amsterdam 1982, xv+378.
42. Ju. T. Lisica and S. Mardešić: *Coherent pro-homotopy and strong shape theory,* Glasnik Mat. **19**(39) (1984) 335–399.
43. Ju. T. Lisica and S. Mardešić: *Strong homology and inverse systems of spaces*, *I, II* Topology Appl. **19** (1985) 29–43, 45–64.
44. D. Veljan: *Refined Euler's inequalities in plane geometries and spaces*, Rad HAZU, Matem. zn. (2022), u tisku.
45. S. Mardešić and J. Segal (eds.): *Geometric topology and shape theory,* Lecture Notes in Math. 1238, Springer, Berlin, 1987.
46. S. Mardešić and T. Watanabe: *Approximate resolutions of spaces and mapping*s, Glasnik Mat. **24**(44) (1989) 587–637.
47. S. Mardešić and A. Prasolov: *Strong homology is not additive*, Trans. Amer. Math. Soc. **307** (1988) 725–744.
48. S.Mardešić and L. Rubin: *Cell-like mappings and non-metrizable compacta of finite cohomological dimensions*, Trans. Amer. Math. Soc. **311** (1989) 53–79.
49. S. Mardešić and J. Segal: *Mapping approximate inverse systems of compacta*, Fund. Math. **134** (1990) 73–91.
50. V. Mardešić: *On support points of segmentally closed convex bodies in the rational plane*, Geom. Dedicata **29** (1989) 279–291.
51. S. Mardešić and N. Uglešić: *On iterated inverse limits,* Topology Appl. **120** (2002) 157–167.
52. S. Mardešić and V. Matijević: *Classifying overlays of topological spaces*, Topology Appl. **113** (2001) 167–209.
53. S. Mardešić and Z. Miminoshvili: *The relative homeomorphism and wedge axioms for strong homology*, Glasnik Mat. **25**(41) (1990) 387–416.
54. S. Mardešić: *Zlatko Janković, 1916 – 1987. Životni put, u: Spomenice preminulim akademicima*, Radovi JAZU **49**(1989) 9–13.
55. S. Mardešić: *Život i stvaralaštvo Željka Markovića*, Priroda **86**(7-8) (1996) 8–12.
56. S. Mardešić: *Razvoj i dostignuća matematike vezane za zagrebačko sveučilište i Hrvatsku*, *u*: *Sveučilište u razvoju znanosti od 1669. do danas*, Sveučilište u Zagrebu, Zagreb, 1990., 56–60.
57. S. Mardešić: *On approximate inverse systems and resolutions,* Fund. Math. **142** (1993) 241–255.

58. S. Mardešić: *Approximating spaces by polyhedra*, *in*: Symposia Gaussiana, Conf. A, (Eds.: Behara/Fritsch/Lintz), W. de Gruyter, Berlin–New York, 1995, 499–505.

59. S. Mardešić: *Nonvanishing derived limits in shape theory*, Topology **35** (1996) 521–532.

60. S. Mardešić: *Strong homology does not have compact supports*, Topology Appl. **68** (1996) 195–203.

61. S. Mardešić and A. Prasolov: *On strong homology of compact spaces*, Topology Appl. **82** (1998) 327–354.

62. S. Mardešić: *Razvitak matematičkih znanosti u Hrvatskoj*, Glasnik Mat. **30** (1995) 363–368 (i sličan članak u: *120 godina PMF-a*, PMF, Zagreb, 1996.)

63. S. Mardešić: *Absolute neighborhood retracts and shape theory*, *in*: History of topology, Chapter 9, (I. M. James, ed.), Elsevier Science, Amsterdam, 1999, pp. 241–269.

64. S. Mardešić: *Strong Shape and Homology*, Springer monographs in mathematics, Berlin, Heidelberg, New York, 2000, xii+489 p.

65. S. Mardešić (ur.): *Danilo Blanuša (1903. – 1987.) u povodu 100. obljetnice rođenja*, HAZU, Zagreb, 2003.

66. S. Mardešić and J. Segal: *History of shape theory and its applications to general topology*, *in*: *Handbook of the History of General Topology* (C. E. Aull and R. Lowen, eds.), Kluwer Acad. Publ. Vol. 3 (2001) 1145–1177.

67. S. Mardešić: *Topology in Eastern Europe, 1900 – 1950*, Topology Proceedings **25** (2000) 397–430.

68. S. Mardešić: *A resolution for the product of a compactum with a polyhedron*, Topology Appl. **133** (2003) 37–63.

69. T. Porter: *Strong Shape and Topology*, Book reviews, Bull. London Math. Soc. **33**(1) (2001) 125–127.

70. S. Mardešić: *Some cellular subdivisions of simplicial complexes*, Glasnik Mat. **45** (2010) 219–290.

71. S. Mardešić: *An existence theorem concerning strong shape of Cartesian products*, Math. Commun. (Osijek) **17** (2012) 313–354.

72. Glasnik matematički vol. **42** (2007) *Dedicated to 80 years of Sibe Mardešić*.

73. S. Mardešić: *On inverse limits of compact spaces. Correction of a proof*, Glasnik Mat. **45**(2) (2010) 525–530.

74. S. Mardešić: *Phantom mappings and a shape-theoretic problem concerning products*, Topology Appl. **178** (2014) 248–264.

75. S. Mardešić: *Elementary examples of essential phantom mappings*, Rad HAZU, Matem. zn. **19** (2015) 143–149.

76. S. Mardešić: *Životni put akademika Vladimira Devidéa (1925. – 2010.)*, *u*: *Spomenice preminulim akademicima HAZU* **166** (2012) 11–16.

77. S. Mardešić: *Juraj Božičević, istaknuti profesor nacrtne geometrije*, Prirodoslovlje **13** (2013) 179–184.

78. S. Mardešić: *Još o Jurju Božičeviću, istaknutom profesoru nacrtne geometrije u Splitu i Zagrebu*, Prirodoslovlje **13** (2013) 297.

79. *In memoriam akademik prof. dr. sc. Sibe Mardešić (Bergedorf, 20. 6. 1927. – Zagreb, 18. 6. 2016.)*, (više autora), Glasnik Mat. **52** (2017) 602–629.

80. T. Dolić: *Sibe Mardešić je otvorena topologija,* 7Dnevno 10. 11. 2017., 12. studenoga 2017.

81. *In memoriam akademik Sibe Mardešić*, Rad HAZU, Mat. zn. **21** (2017) 1–240, te 13 znanstvenih radova posvećenih njemu.

82. S. Mardešić: *Not every metrizable compactum is the limit of an inverse sequence with a simplicial bonding map*, Topology Appl. **239** (2018) 120–122.